How to Prepare and Run a Simulation

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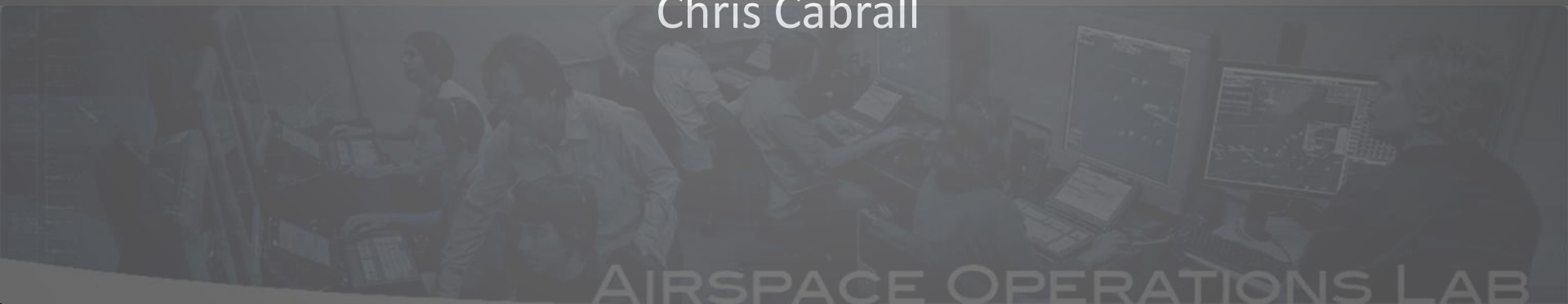
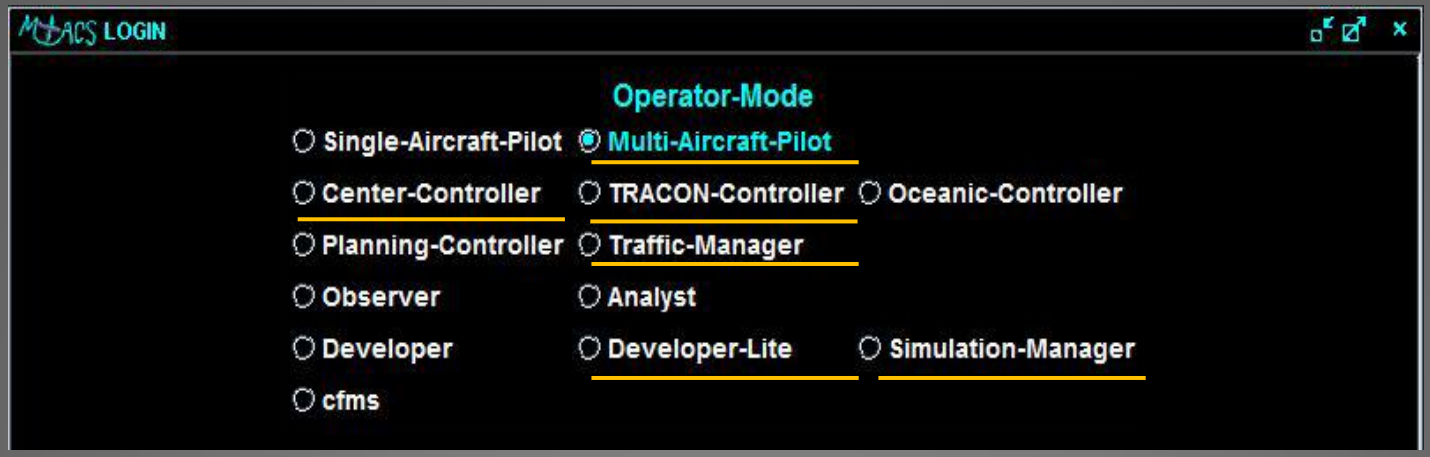


Outline

- Operator modes
- Scenario Control “running a simulation”
- Flightdeck
- STARS display (What are its features and functions ←→ how did we get them)
  - Airspace adaptation “scope”
  - Configuring the controller’s workstation (What can be seen? Basic features, various commands)
    - ATC DST configuration
    - STARS / DSR PlanView setup
    - Datablocks and waypoints
  - CMS tools
- DSR display
  - What can be seen on the radar display
  - ATC procedures
- Scenario/Weather Editing
- Data collection
- Q&A

Choosing the Operator Mode

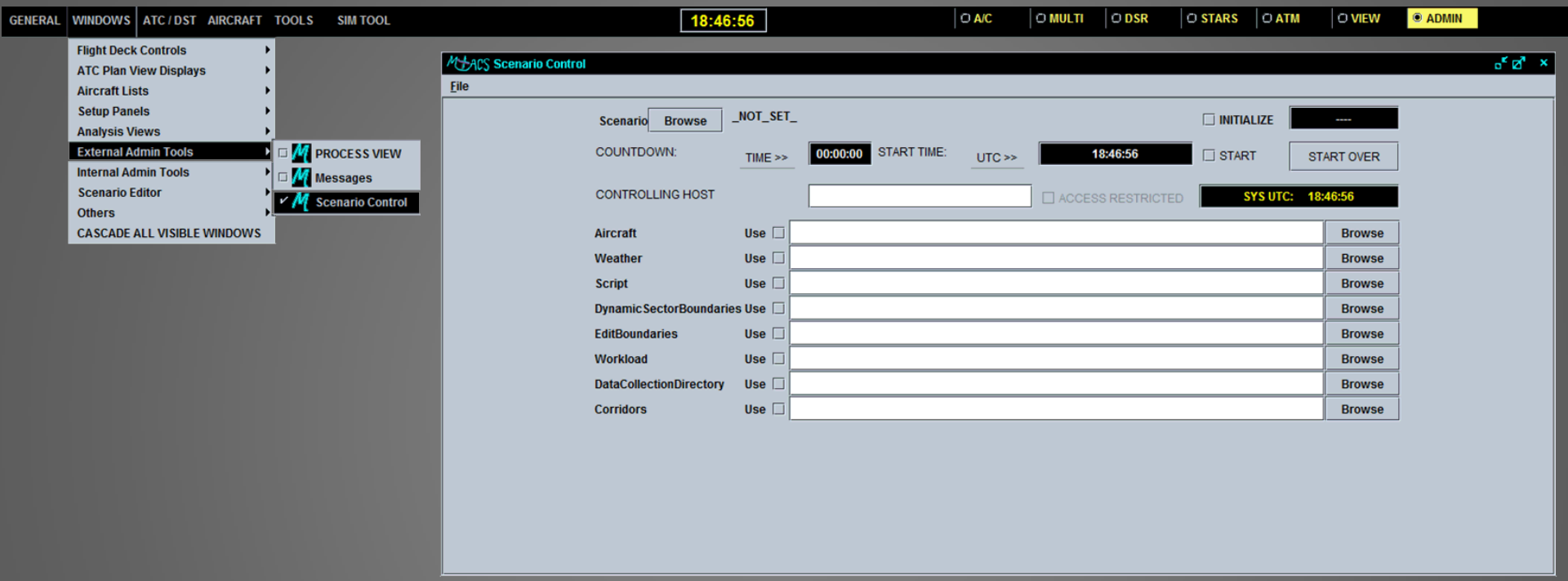


CA1:

- **Simulation Manager** (simulation control)
- **TRACON Controller** (sectors 258, 264, …)
- **Center-controller** (sectors 24, 25, 75, and ghost station)
- **Multi-Aircraft Pilot**
- **Traffic Manager** (additional views for wall projection)
- **Developer Lite, Observer** (researcher stations)

More information under: https://aol1.arc.nasa.gov:8443/display/macs/Getting+started+with+MACS

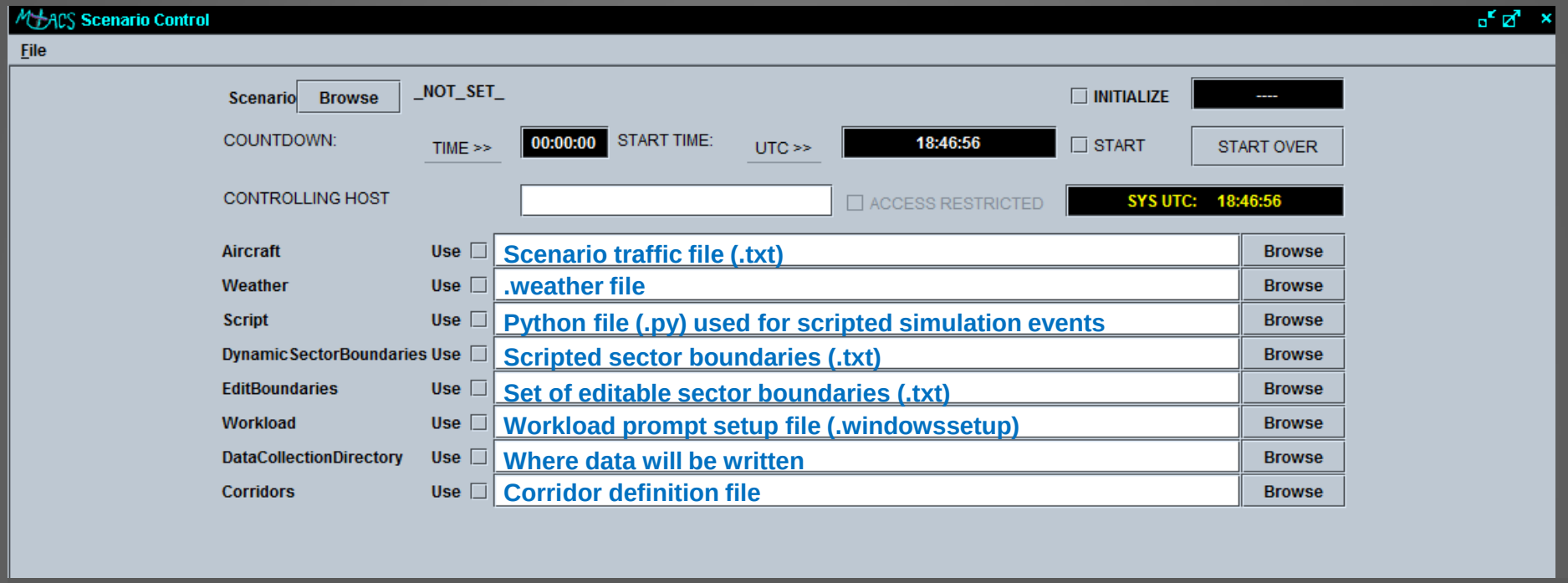
Scenario Control Interface



Scenario Control

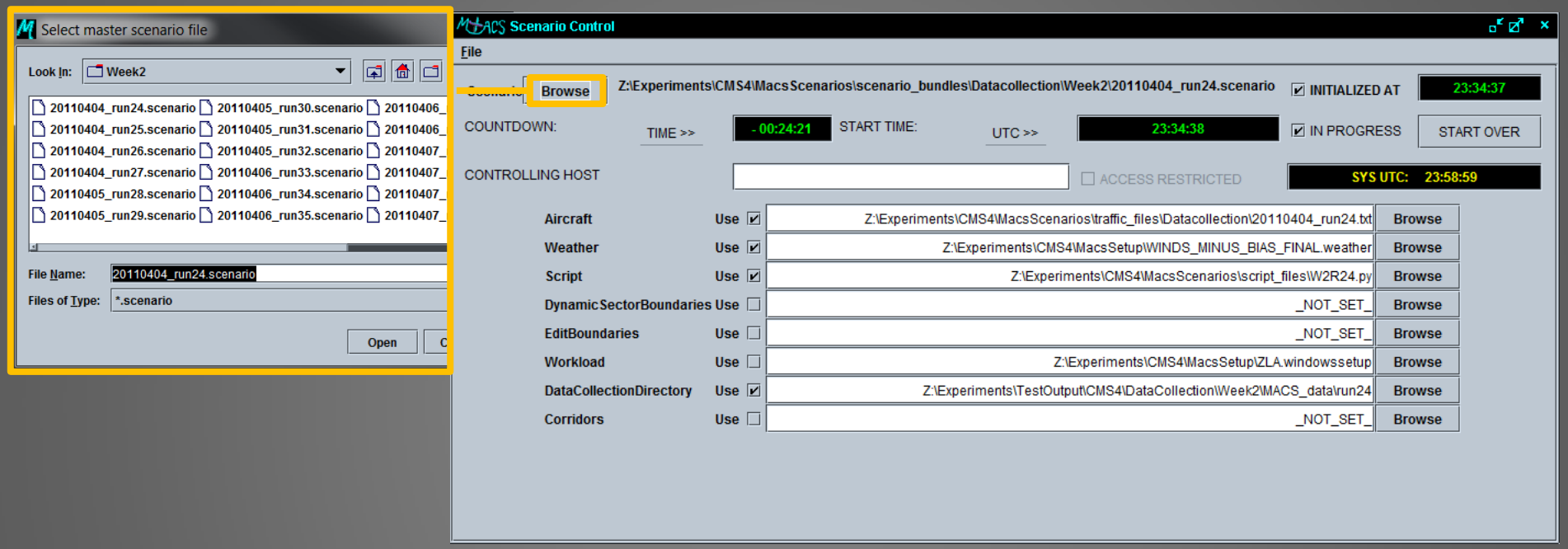
- Scenario bundles are created and loaded through the Scenario Control interface
- Scenario Control also used for starting and stopping simulation runs

Scenario Control Interface



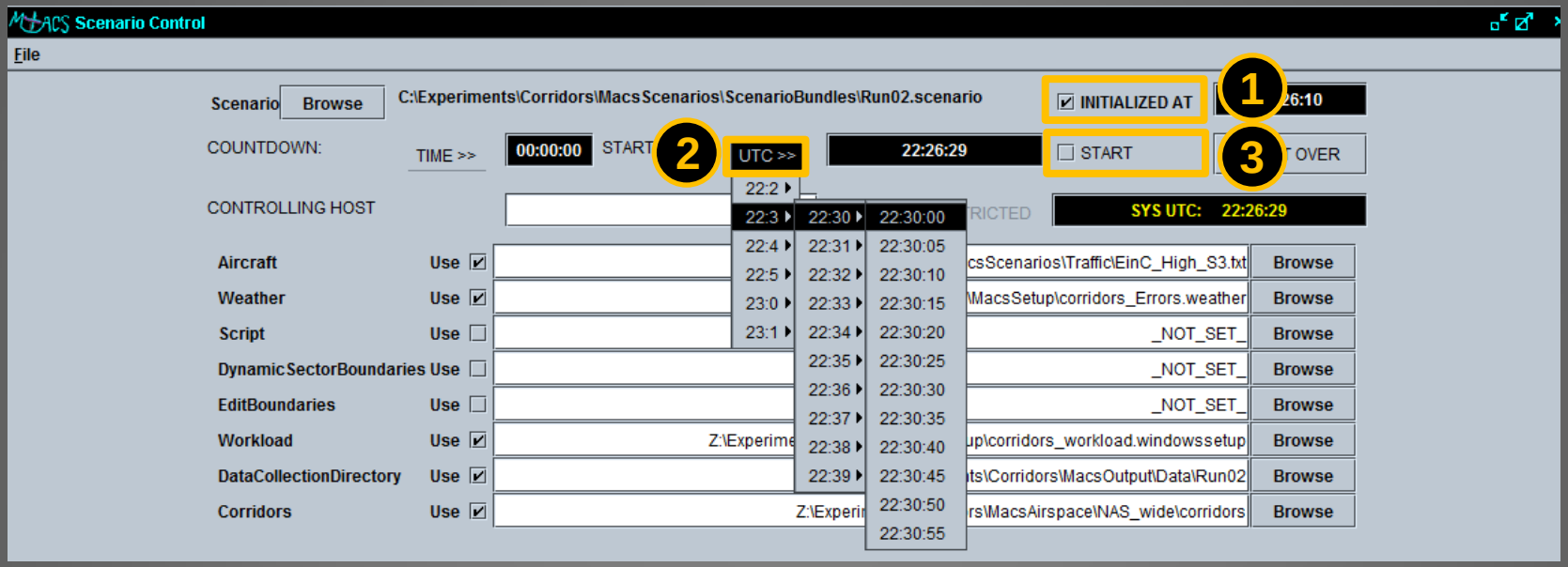
- Dependencies exist between local settings and the scenario bundle
- “Use” boxes must be checked for associated file to be distributed
  - If not, whatever is defined in a position’s master configuration file will be loaded
- When including convective weather, make sure proper path for .xml file is defined in the weather setup file’s “Wx Selection” tab and checkbox is checked
- Ensure ADRSs are collecting data (if desired)

Scenario Control Interface



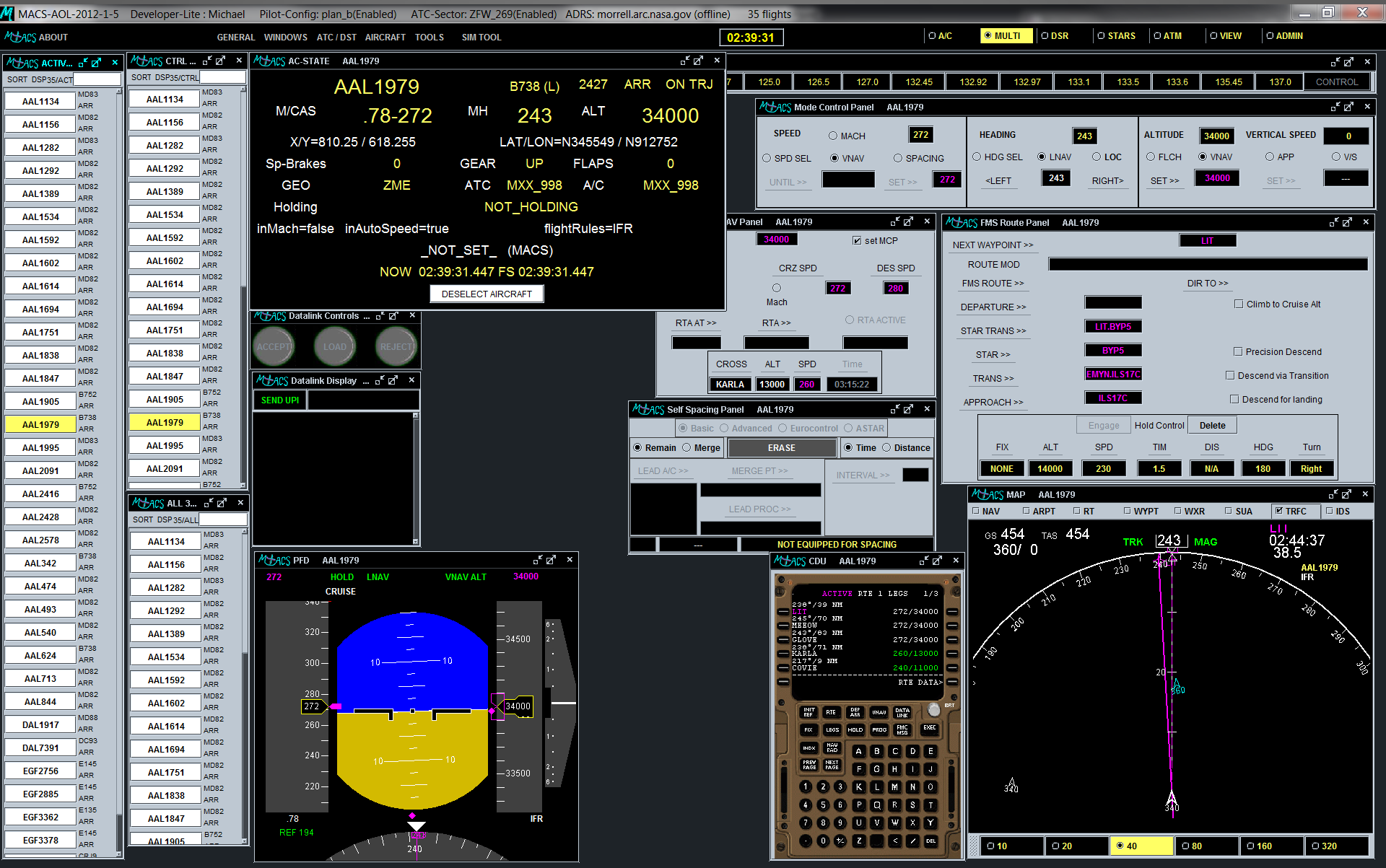
- Bundles can be loaded through the File menu or Browse portal (as shown)
- Ensure settings are correct. If ANY changes are made, make sure file is saved

Scenario Control Interface

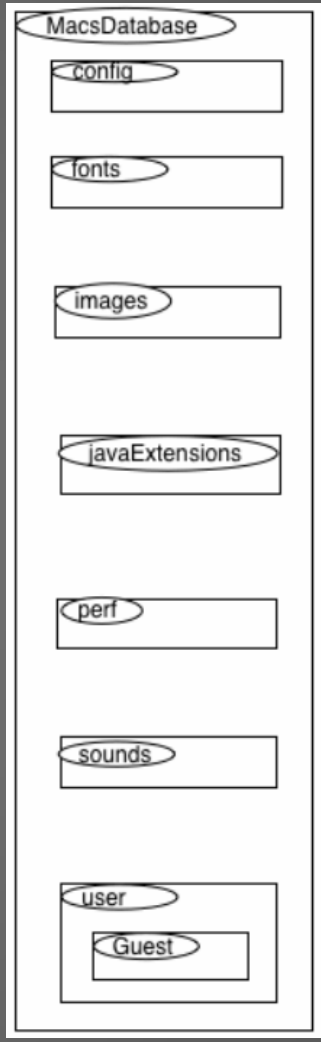


1. Check the “INITIALIZED AT” box to begin startup process
2. Select a desired and realistic start time through the “UTC” flyout menus
3. Check the “START” box to distribute the bundle
4. A countdown will begin in the “TIME” window

Example Stations: Pseudo Pilot Station



Adjusting the Airspace Adaptation



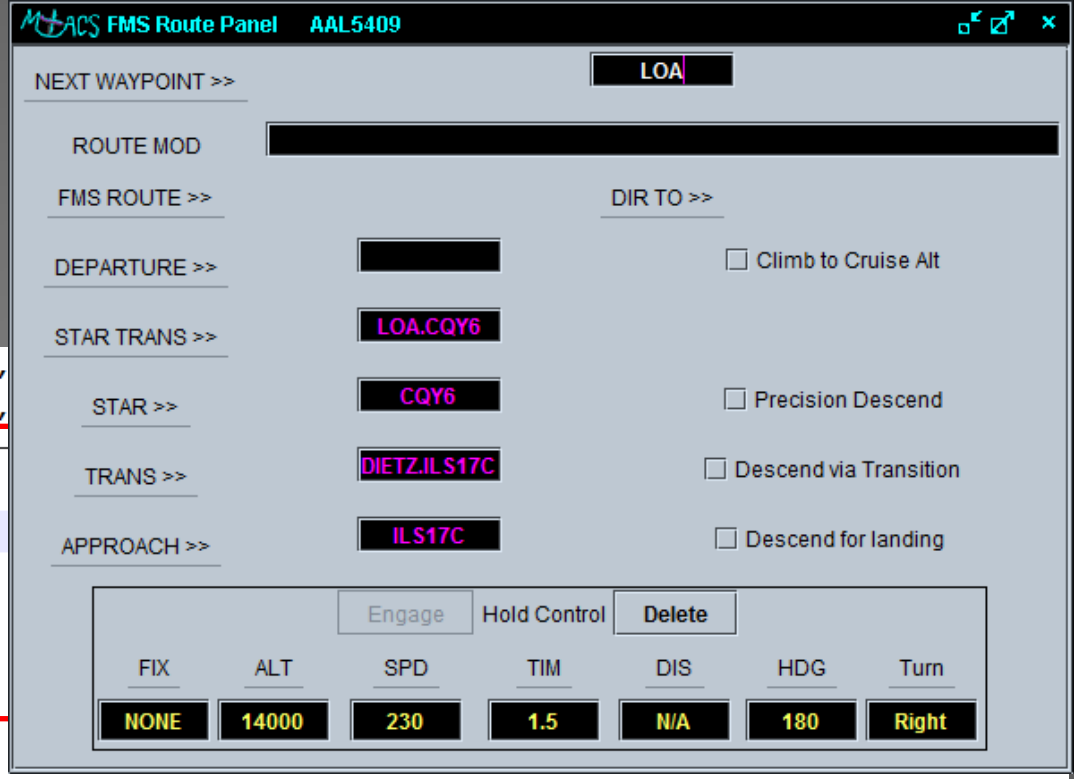
- *Pilot *.cfg files: setting rules for pilot ownership*

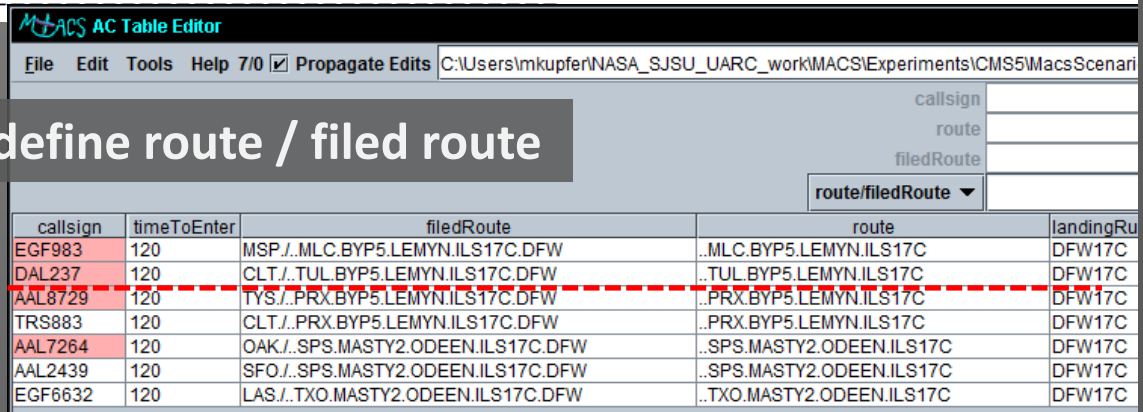
```
NAME          zla_201

RULES         DISPLAY
sector        all
active        yes
playback      no
source        macs
flights       all
status        all
callsign      all
cdti          yes
END_RULES

RULES         CONTROL
sector        ZLA_201
active        yes
```

fms_procedures file

..\MacsAirspace\ZFW_DFW\custom\

```
STAR-TRANS   DFW ALL ALL TXK.BYP5     TXK,GLOVE,
STAR-TRANS   DFW ALL ALL TUL.BYP5     TUL,LOSZY,
#-------------------------------------------
#MASTY TWO (NW)
STAR         DFW ALL ALL          MASTY2
#CEDAR CREEK (SE)
STAR         DFW ALL ALL          CQY6
#BONHAM FIVE (NE)
STAR         DFW ALL ALL          BYP5
#
#-------------------------------------------------------------------
APP-TRANS    DFW DFW17C  ALL      LEMYN.ILS17C     LEMYN,CARBN:AT6000:S210,PENNY:AT5000:S190
APP-TRANS    DFW DFW17C  ALL      ODEEN.ILS17C     ODEEN,BOSSL:AT6000:S210,BOSSI,PENNY:AT5000:S190
APP-TRANS    DFW DFW17C  ALL      DIETZ.ILS17C     DIETZ:AT11000:S240,CARBN:AT6000:S210,PENNY:AT5000:S190
#-------------------------------------------------------------------
APP          DFW DFW17C  ALL      ILS17C           PENNY:AT5000:S190,ZINGG,JIFFY:AT2300:S170,DFW17C:AT562
#-------------------------------------------
```



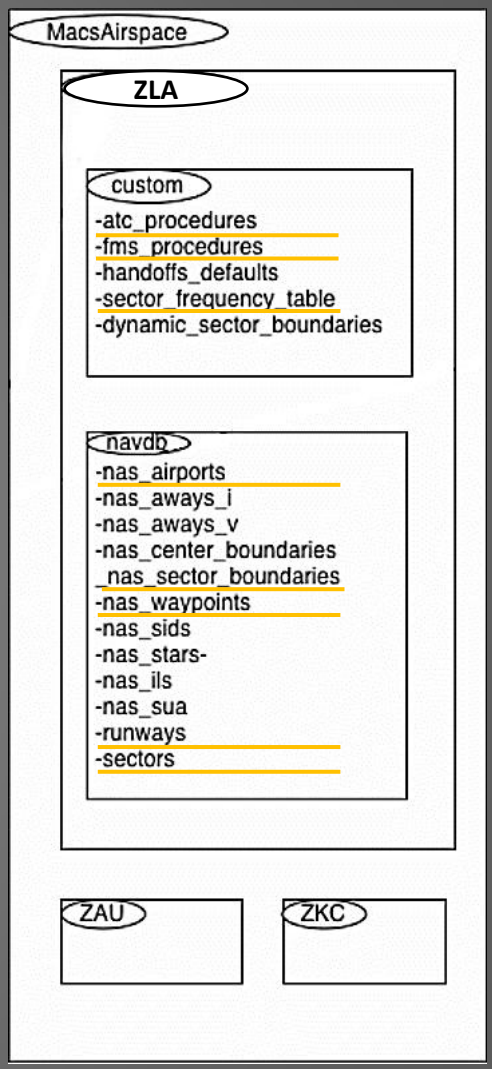


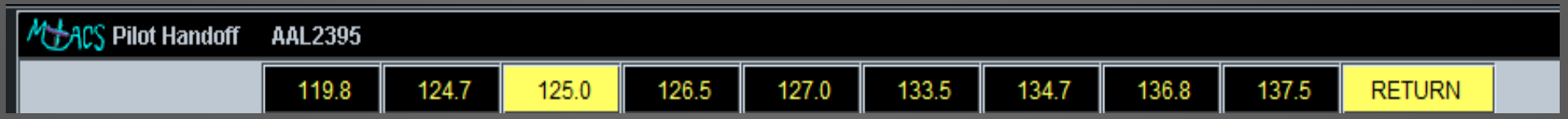
- Used in the traffic scenario to define route / filed route

Adjusting the Airspace Adaptation

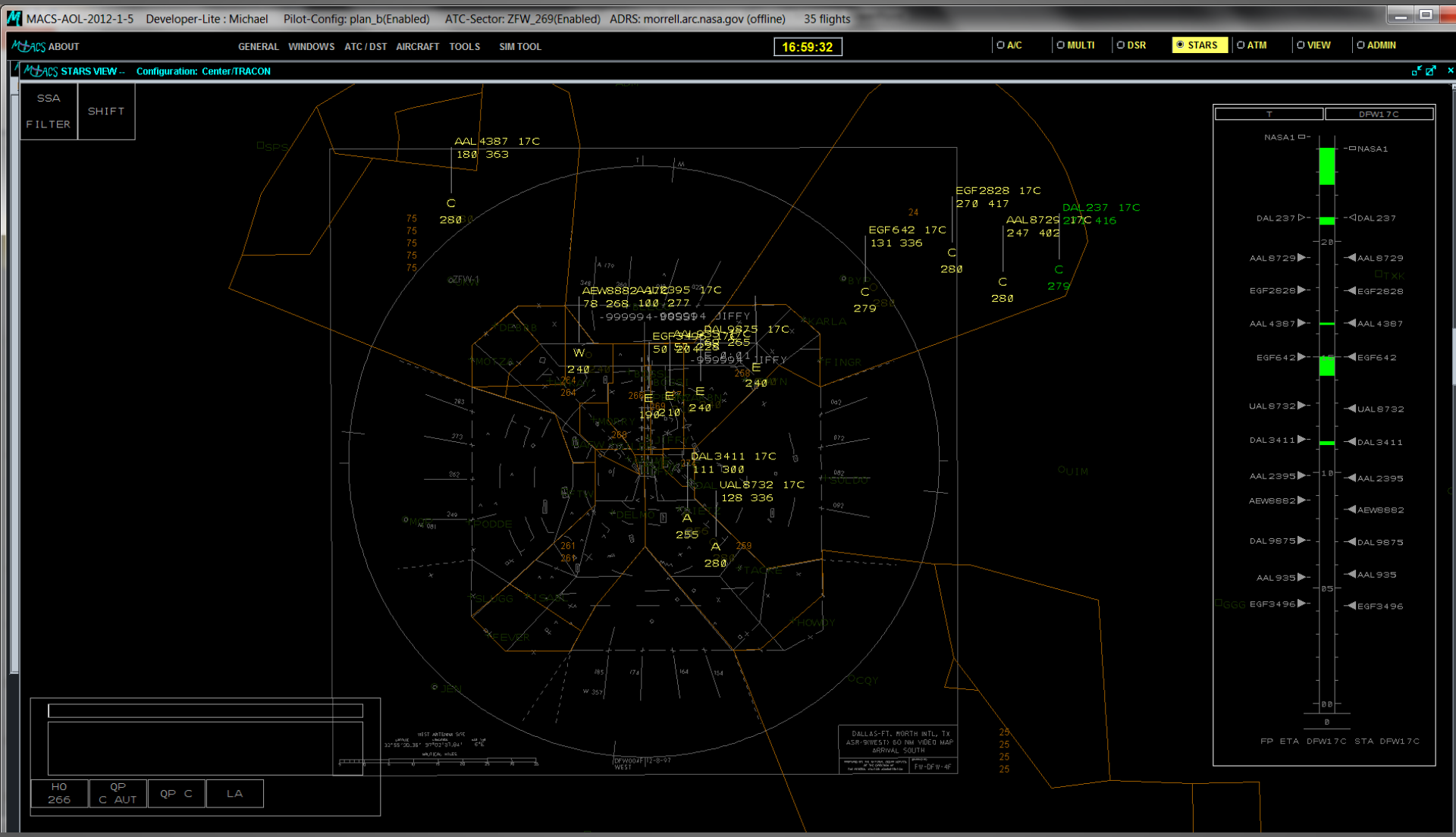
- sector_frequency_table: setting the radio frequencies

```
#ZLA_37, en route ghost
ZLA_37 127.6
#
#ZLA_201, zuma
ZLA_201 124.5
#
#ZLA_202, stadium
ZLA_202 122.1
#
#ZLA_203, downe
ZLA_203 128.3
```



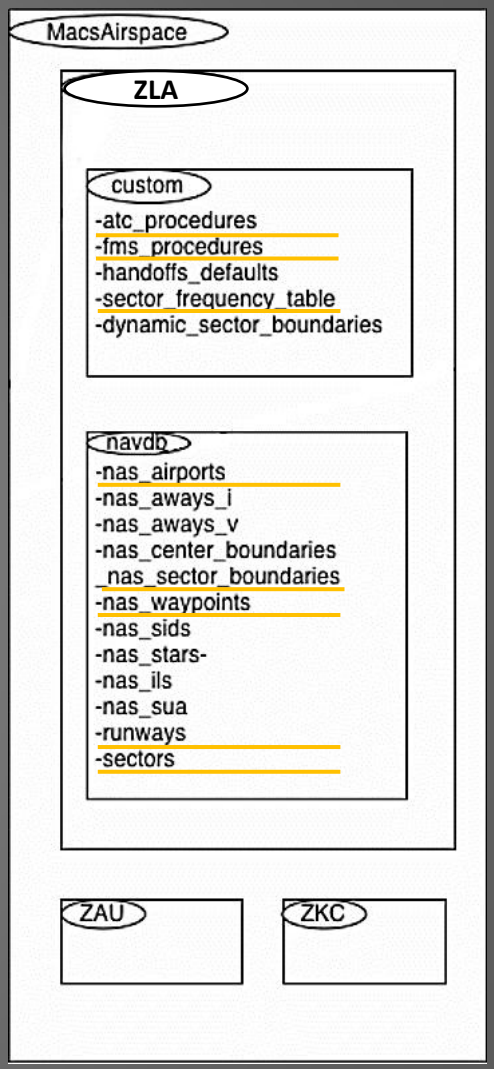


TRACON controllers: STARS display



Adjusting the Airspace Adaptation

- sectors file: set sector name, position symbol, etc.

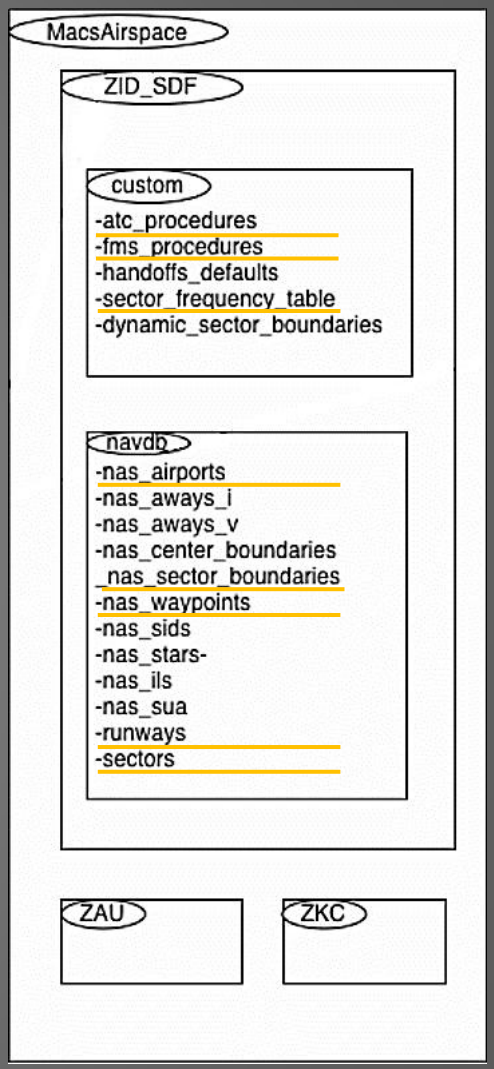



```
TRACON Sectors
#num     center_point     radius   arpt     rwy      video_map    position     position
#    lat long                      file          name             symbol
#
201 334445   1182010 50   LAX all  none.dat      zuma             Z
202 334445   1182010 50   LAX all  none.dat      stadium          S
203 334445   1182010 50   LAX all  none.dat      downe            D
204 334445   1182010 50   LAX all  none.dat      feeder           F
205 334455   1182010 50   LAX all  none.dat      feeder_south     U
206 334445   1182010 50   LAX all  none.dat      tower            T
207 334445   1182010 50   LAX all  none.dat      planner          P
256 335633   1182429 40   LAX 6L   none.dat      TMC              E
```

Adjusting the Airspace Adaptation

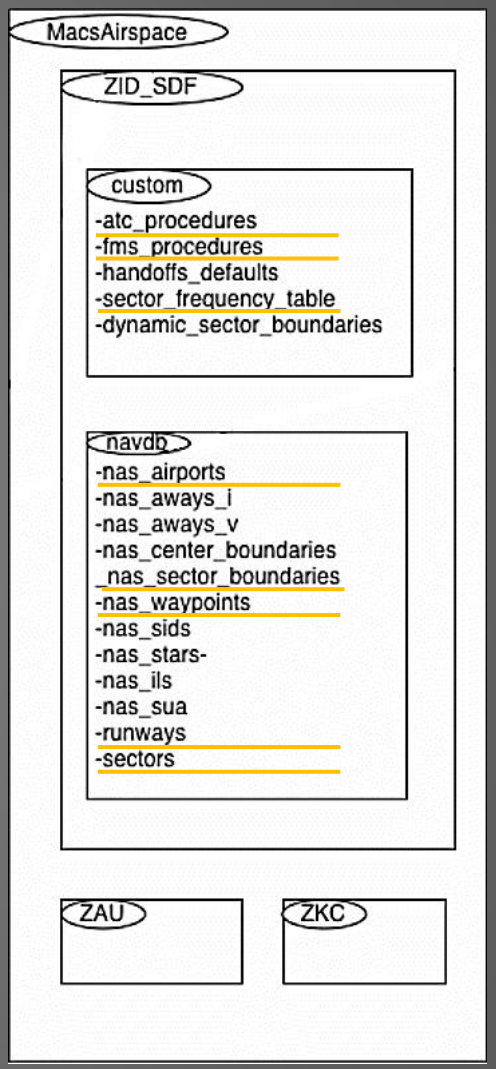
- nas_sector_boundaries: defining the perimeter of the sectors

```
sector       20101
region       include
altitude           070/190
vertex   335426   1182631
vertex   340946   1192439
vertex   341906   1192503
vertex   342954   1185959
vertex   343048   1185019
vertex   340604   1184104
vertex   340559   1182653
```



Adjusting the Airspace Adaptation

- airports: defining airports and their reference point location

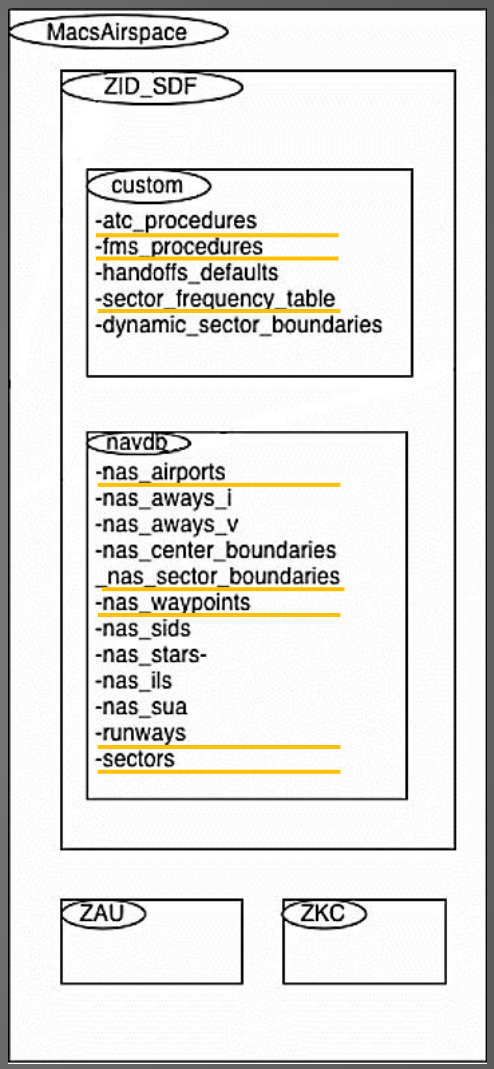


#id	lat	long	elev	loc	
#					
AAA		400931	892006	5	I
AAS		372130	851834	9	I
ABE		403908	752625	4	E
ABEL		332500	1151000	2	I
ABI		322441	994055	18	I
ABQ		350225	1063634	54	E
ABY		313208	841140	1	E

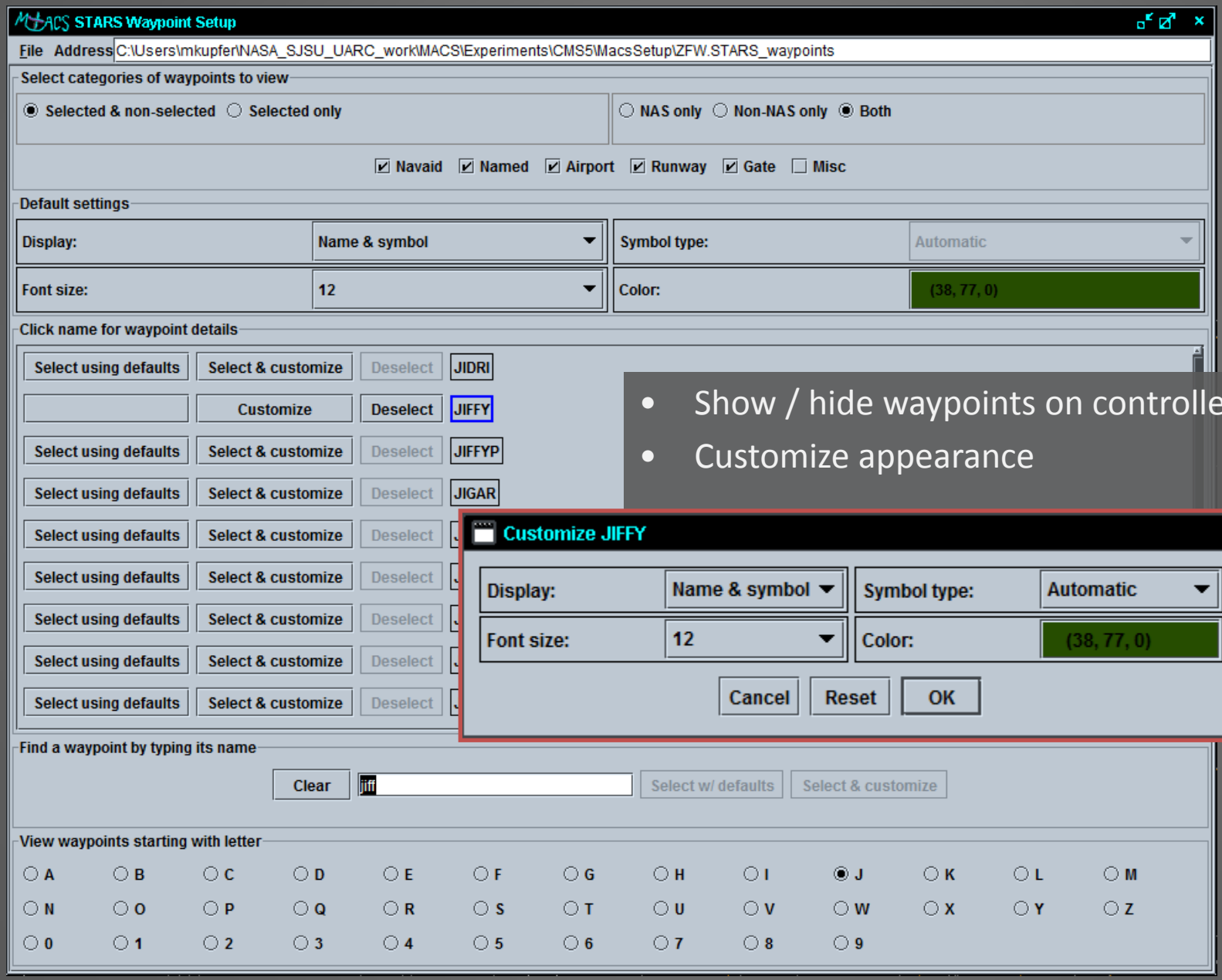
Adjusting the Airspace Adaptation

- waypoints: defining waypoints and their location

#	name	lat	long	var	elev
1	SHASTA	340427	1181134	0	1
1	GREENE	335952	1181053	0	1
1	BLACKE	335812	1181335	0	1
1	LASSEN	335829	1181041	0	1



STARS / DSR Waypoints Setup

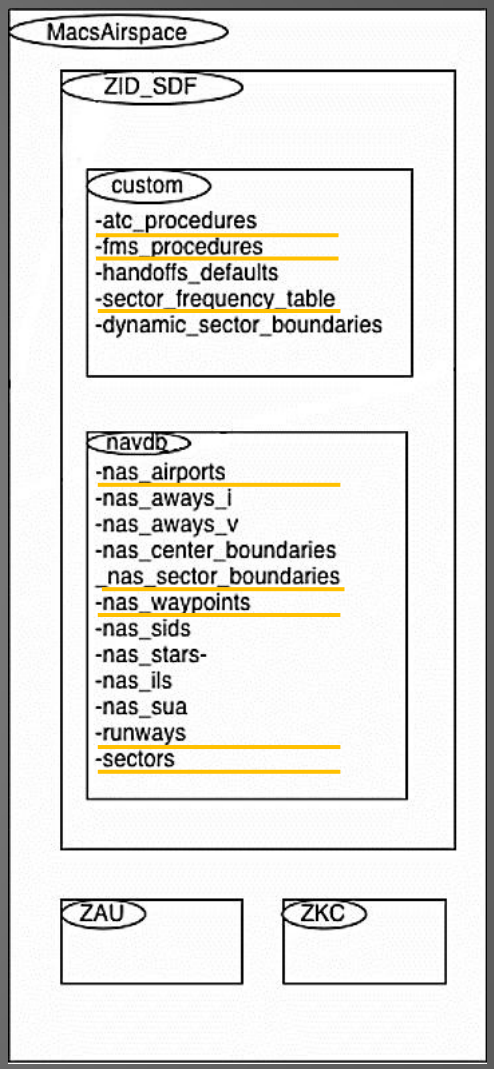


- Show / hide waypoints on controller scope
- Customize appearance

Adjusting the Airspace Adaptation

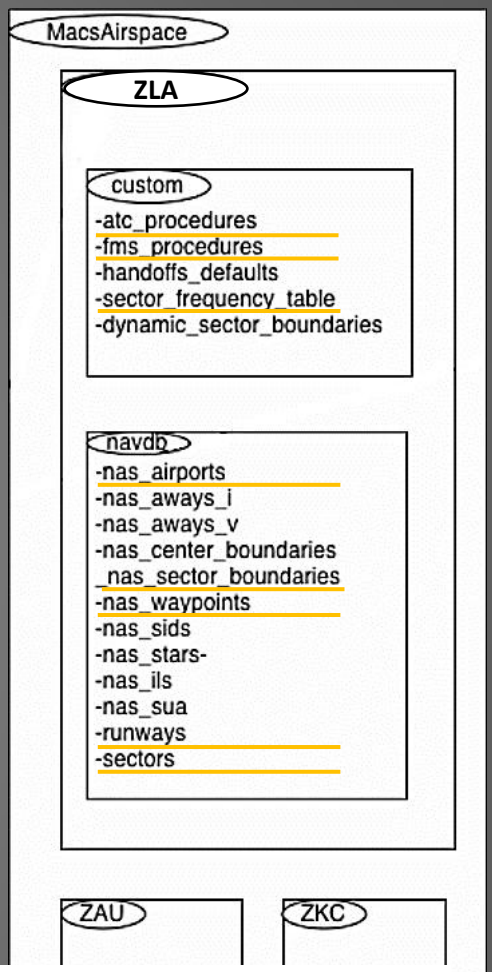
- runways: defining runways and their reference point location

```
runway  24R
waypoint              LAX24R
true_course           264.34
approach_distance         6.41
intercept_altitude        2167
approach_gate             LAX_24R_APCGT
final_approach_fix        ROMEN
extended_final            LAX_24R_XFNL
back_of_dump_wpt          LAX_24R_BOD
```



Adjusting the Airspace Adaptation

- fms_procedures: defining STARS, approaches, etc.



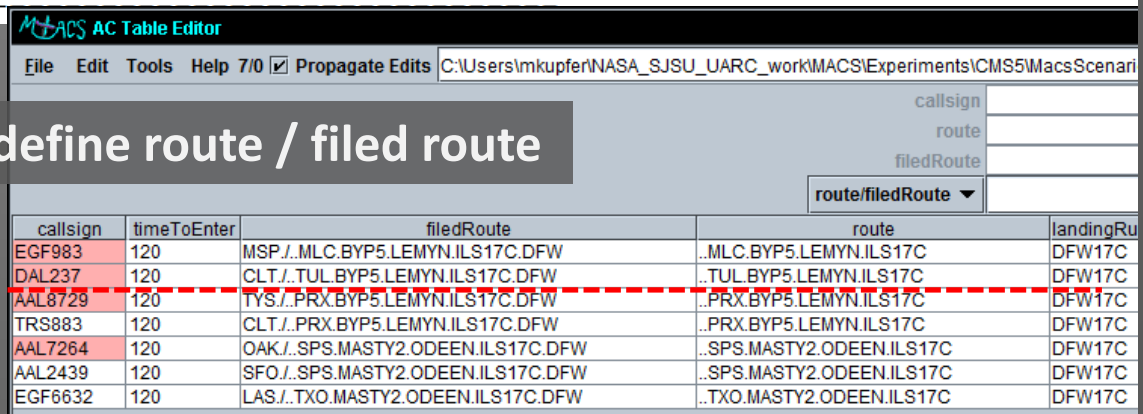

```
STAR    LAX ALL ALL    RIIVR2    GRAMM:AT17000:S280,RUSTT,RIIVR
STAR    LAX ALL ALL    SEAVU2    KONZL:AT17000:S280,CATAW,SEAVU
STAR    LAX ALL ALL    OLDEE1    LAADY:AT17000:S280,SEAVU
STAR    LAX ALL ALL    SHIVE1    SHIVE:AT15500:S280,MADOW:AT10000:S240,SLI:AT7300:S210
STAR    LAX ALL ALL    SADDE7    SADDE:AT11500:S240,BAYST,CULVE:AT7100:S210
STAR    LAX ALL ALL    LEENA2    SXC:AT17000:S280,CLUSTR,MADOW:AT10000:S240,SLI:AT7300:S210
```

fms_procedures file

..\MacsAirspace\ZFW_DFW\custom\

```
STAR-TRANS   DFW ALL ALL TXK.BYP5     TXK,GLOVE,KARLA:AT13000:S260
STAR-TRANS   DFW ALL ALL TUL.BYP5     TUL,LOSZY,MAMEE,BIRLE,GAATZ,BYP,KARLA:AT13000:S260
#-------------------------------------------------------------------
#MASTY TWO (NW)
STAR         DFW ALL ALL          MASTY2          GREGS:AT10000:S240,ODEEN
#CEDAR CREEK (SE)
STAR         DFW ALL ALL          CQY6            HOWDY:AT18000:S280,BELLS,TACKE,DIETZ:AT11000:S240
#BONHAM FIVE (NE)
STAR         DFW ALL ALL          BYP5            KARLA:AT13000:S260,COVIE:AT11000:S240,LEMYN
#
#-------------------------------------------------------------------
APP-TRANS    DFW DFW17C  ALL      LEMYN.ILS17C    LEMYN,CARBN:AT6000:S210,PENNY:AT5000:S190
APP-TRANS    DFW DFW17C  ALL      ODEEN.ILS17C    ODEEN,BOSSL:AT6000:S210,BOSSI,PENNY:AT5000:S190
APP-TRANS    DFW DFW17C  ALL      DIETZ.ILS17C    DIETZ:AT11000:S240,CARBN:AT6000:S210,PENNY:AT5000:S190
#-------------------------------------------------------------------
APP          DFW DFW17C  ALL      ILS17C          PENNY:AT5000:S190,ZINGG,JIFFY:AT2300:S170,DFW17C:AT562
#-------------------------------------
```

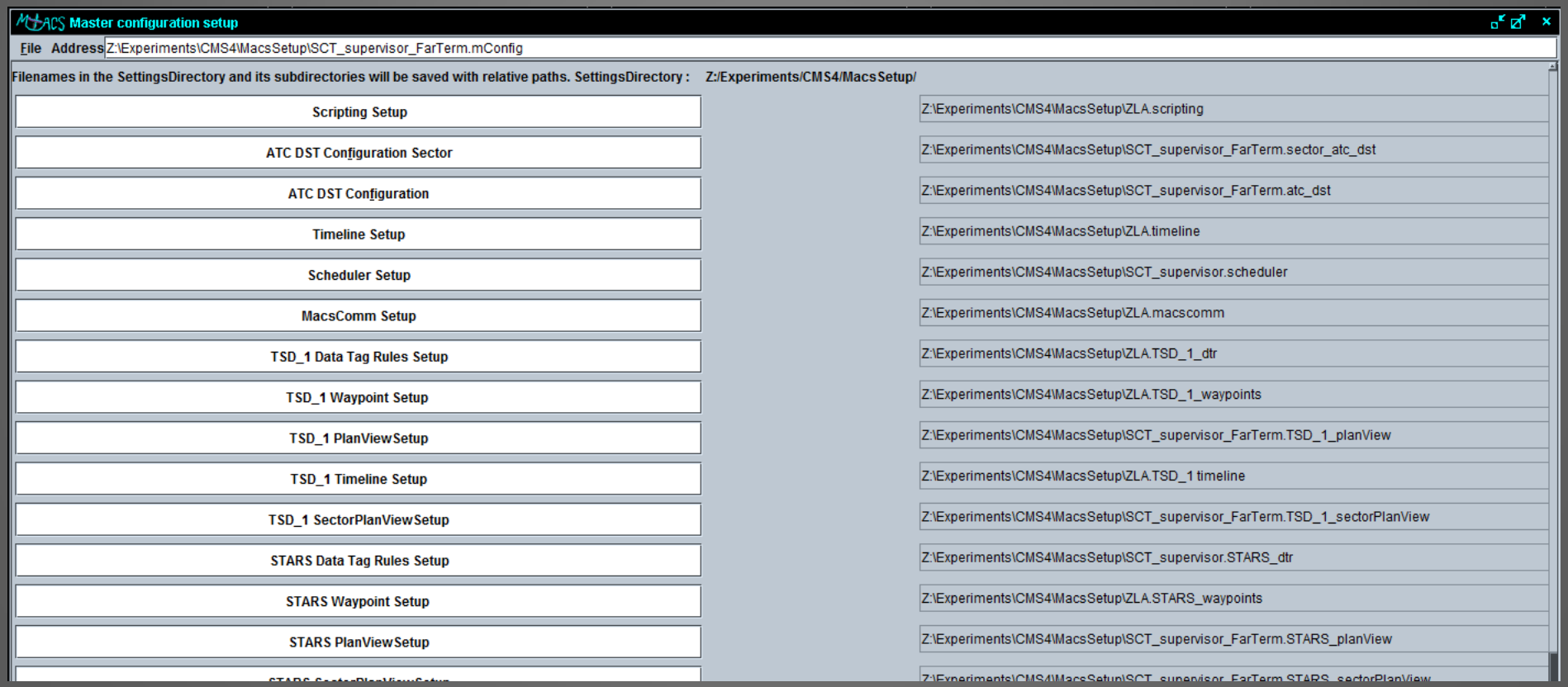
- Used in the traffic scenario to define route / filed route



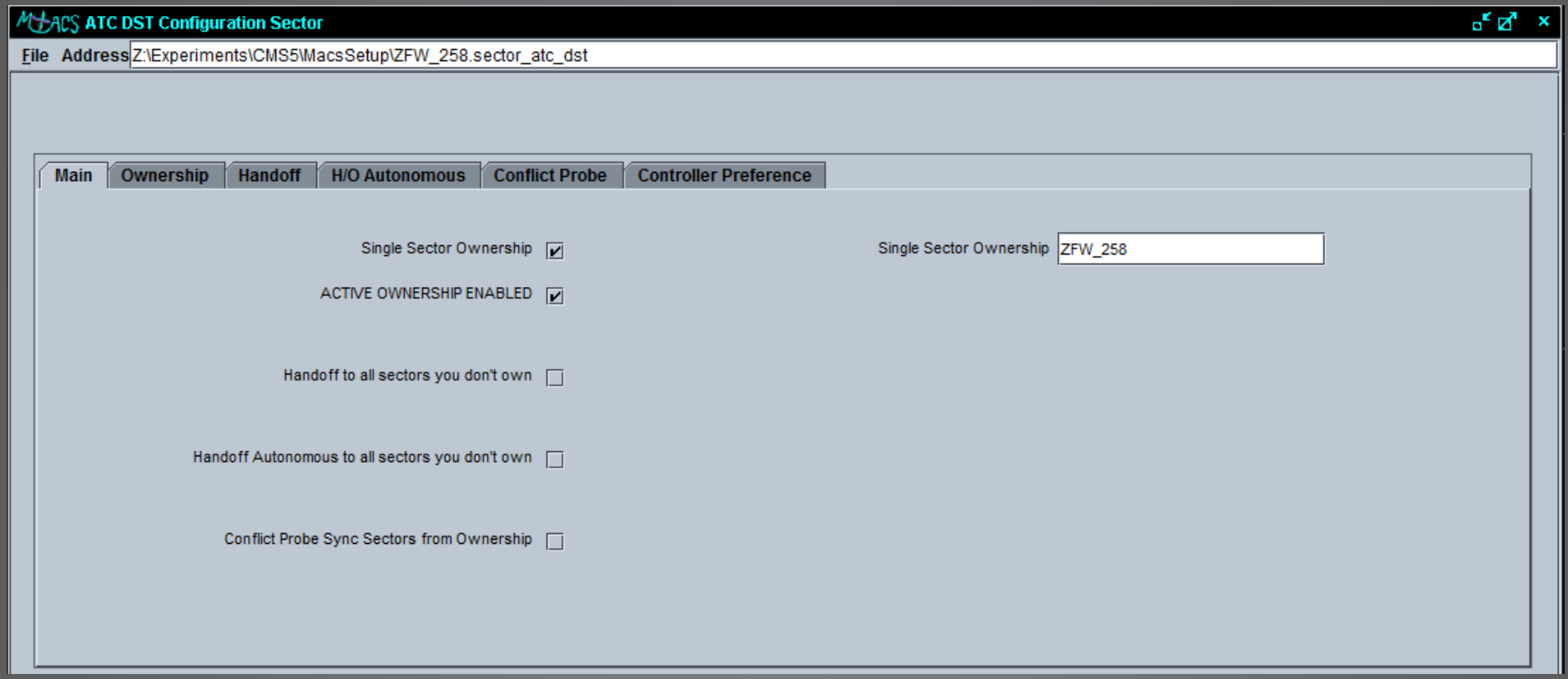
callsign	timeToEnter	filedRoute	route	landingRu
EGF983	120	MSP./..MLC.BYP5.LEMYN.ILS17C.DFW	..MLC.BYP5.LEMYN.ILS17C	DFW17C
DAL237	120	CLT./..TUL.BYP5.LEMYN.ILS17C.DFW	..TUL.BYP5.LEMYN.ILS17C	DFW17C
AAL8729	120	TYS./..PRX.BYP5.LEMYN.ILS17C.DFW	..PRX.BYP5.LEMYN.ILS17C	DFW17C
TRS883	120	CLT./..PRX.BYP5.LEMYN.ILS17C.DFW	..PRX.BYP5.LEMYN.ILS17C	DFW17C
AAL7264	120	OAK./..SPS.MASTY2.ODEEN.ILS17C.DFW	..SPS.MASTY2.ODEEN.ILS17C	DFW17C
AAL2439	120	SFO./..SPS.MASTY2.ODEEN.ILS17C.DFW	..SPS.MASTY2.ODEEN.ILS17C	DFW17C
EGF6632	120	LAS./..TXO.MASTY2.ODEEN.ILS17C.DFW	..TXO.MASTY2.ODEEN.ILS17C	DFW17C

Master configuration setup

- MACS settings are specified in various setup files
- Master configuration file holds the references to all available setup files
- Individual vs. common setup file (Attention! Setup file edits)



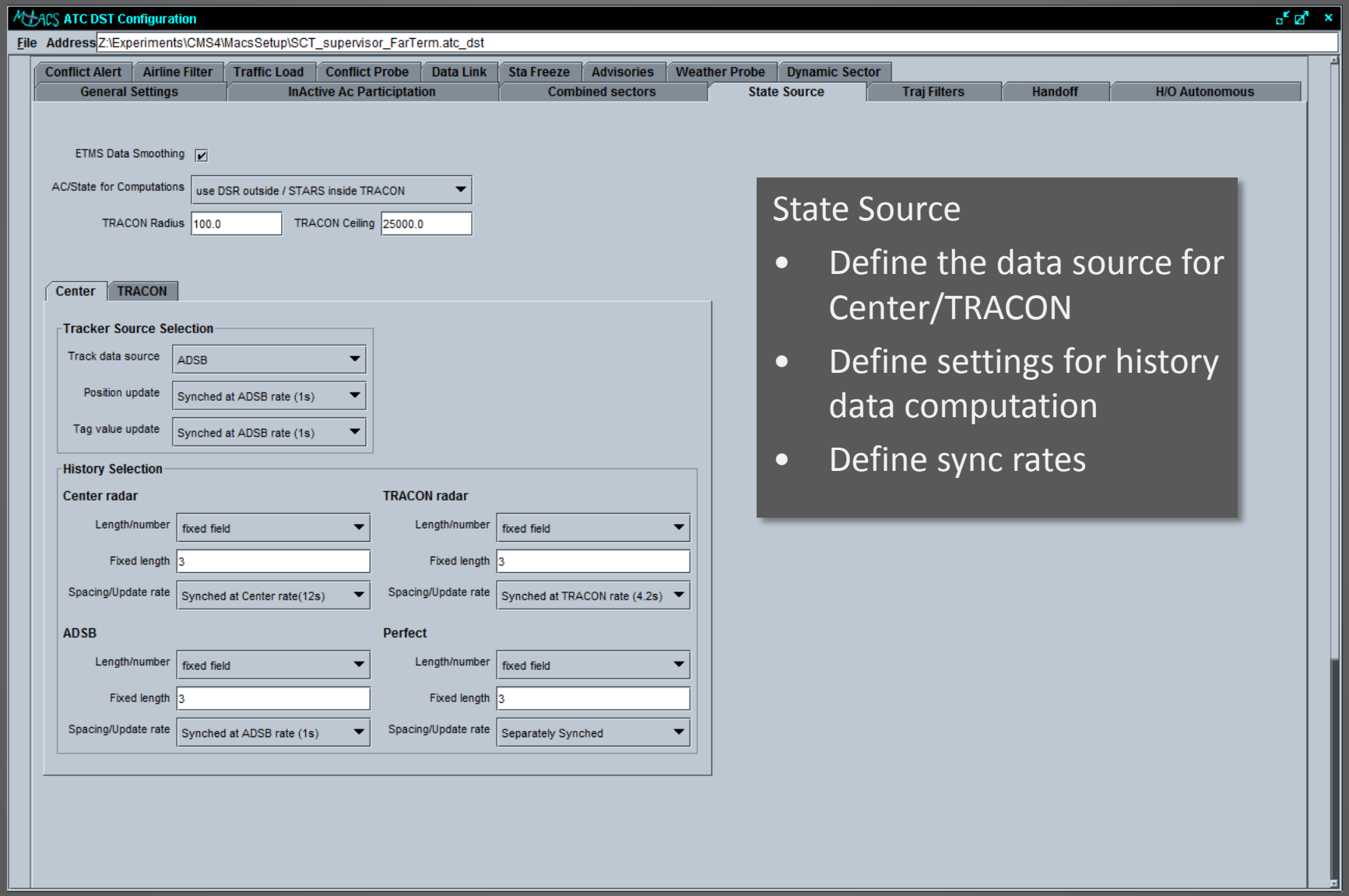
ATC DST Configuration Sector



Main tap

- Set the sector ownership
- Set sector related handoff and conflict probe rules

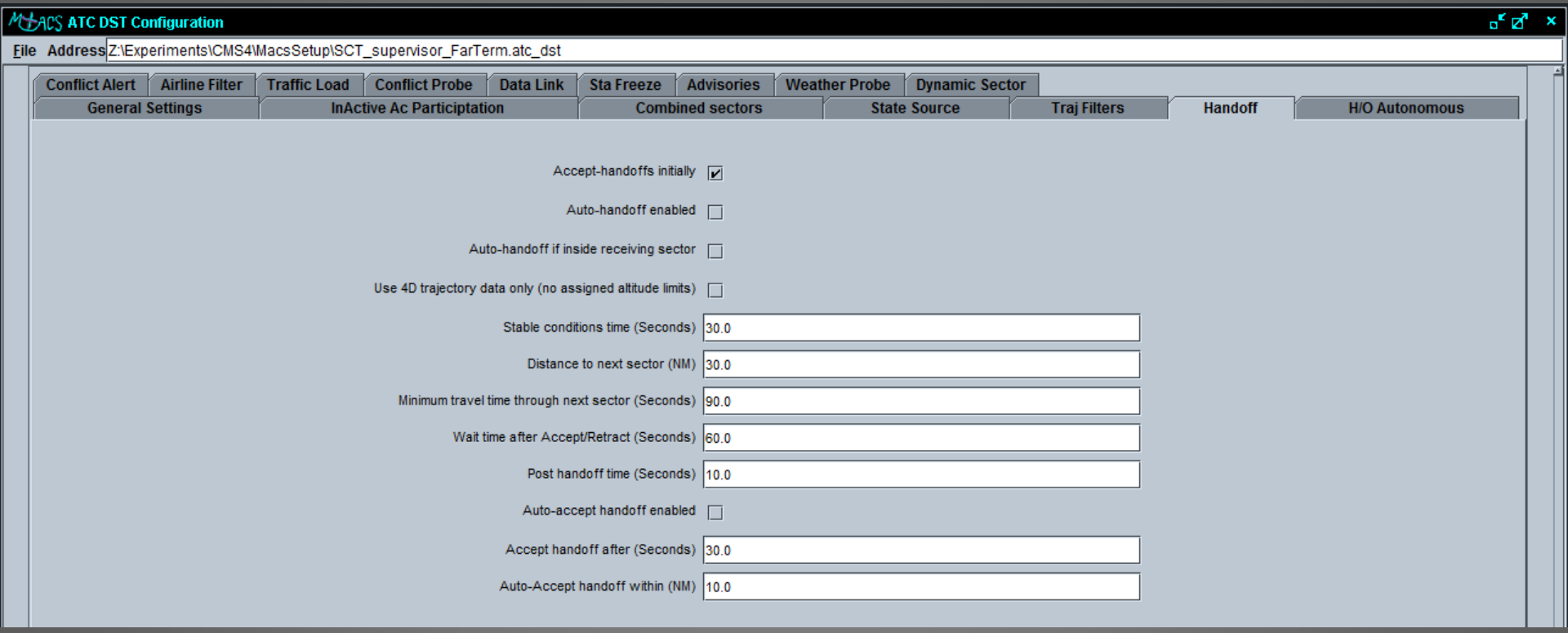
Other ATC DST Configuration settings



State Source

- Define the data source for Center/TRACON
- Define settings for history data computation
- Define sync rates

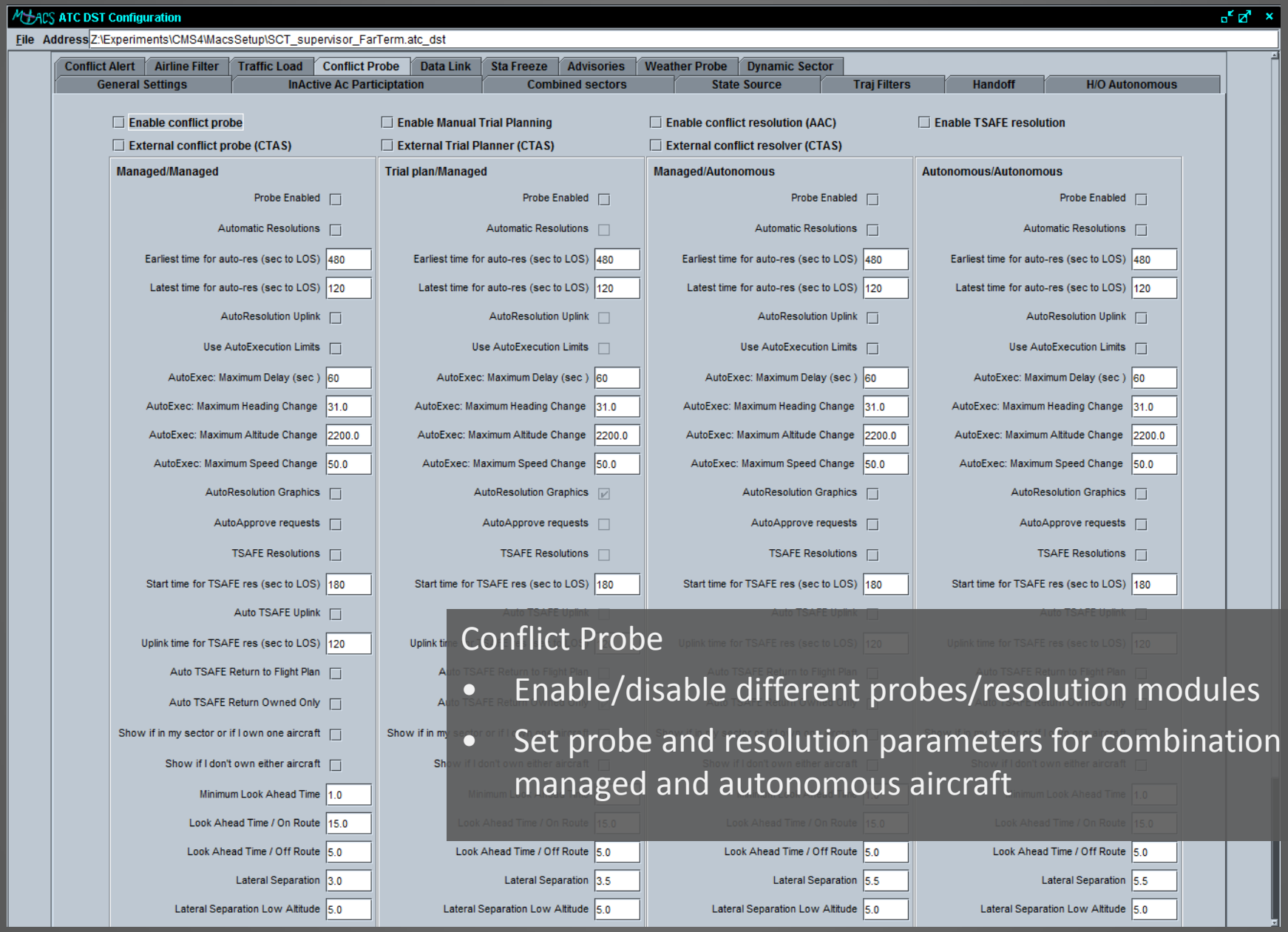
Other ATC DST Configuration settings



Handoff

- Enable/disable auto-handoff
- Define rules for (auto-) handoff (when, where, etc.)

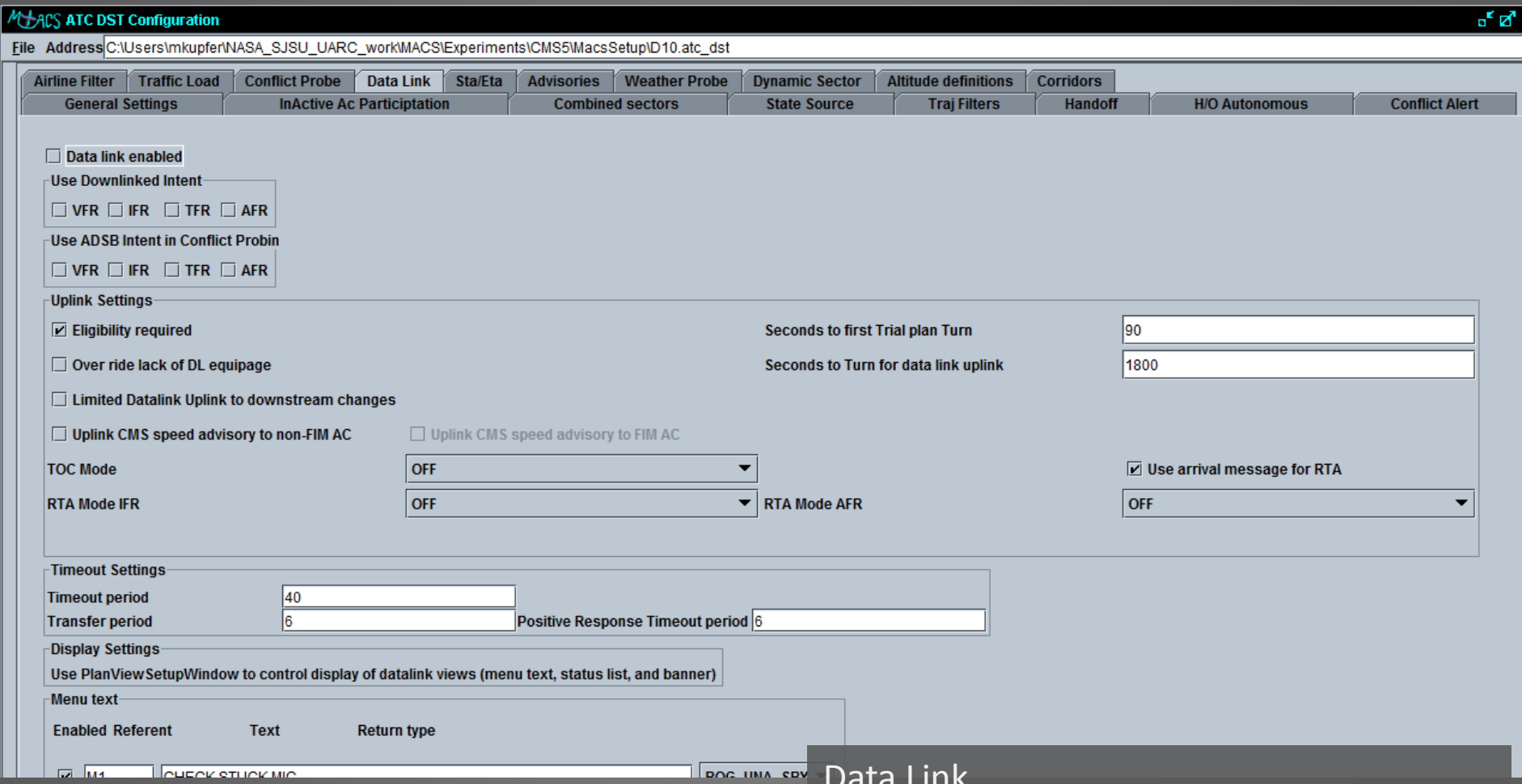
Other ATC DST Configuration settings



Conflict Probe

- Enable/disable different probes/resolution modules
- Set probe and resolution parameters for combination of managed and autonomous aircraft

Other ATC DST Configuration settings

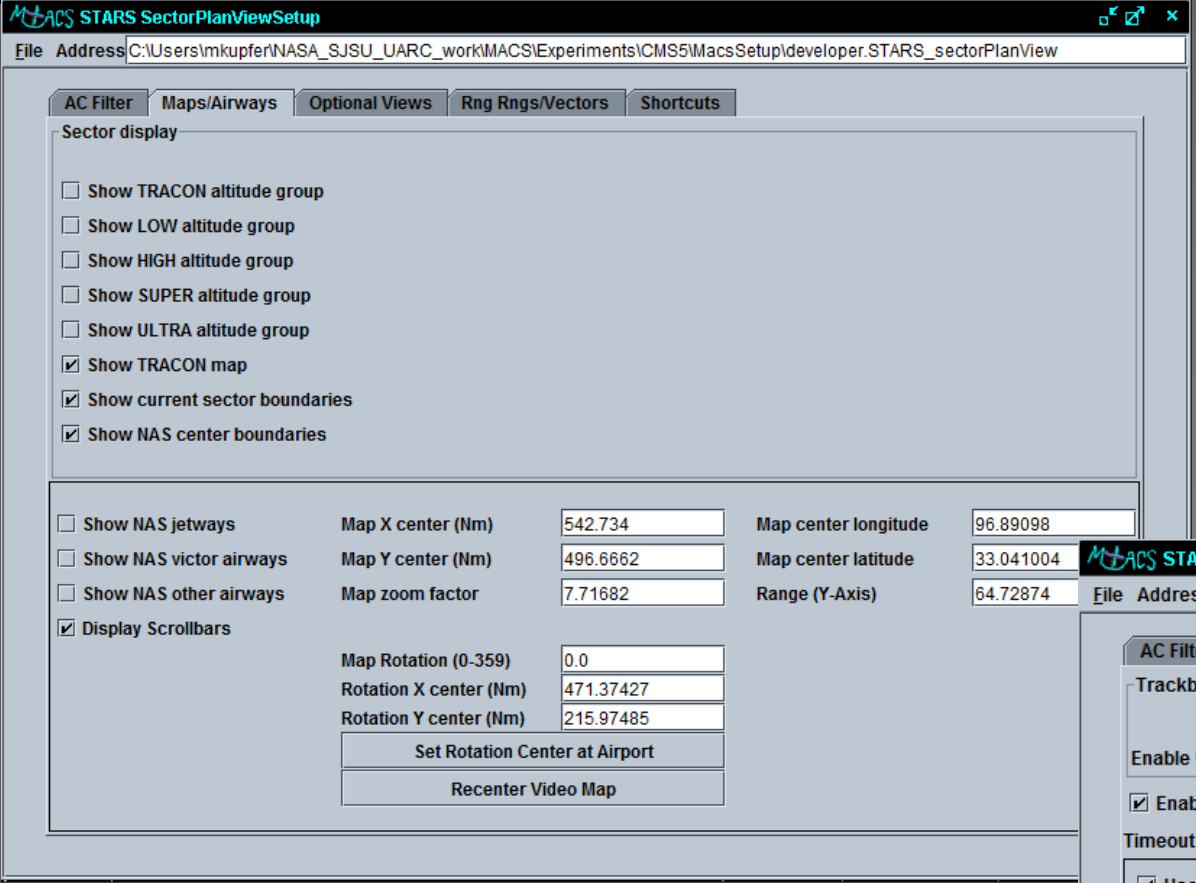


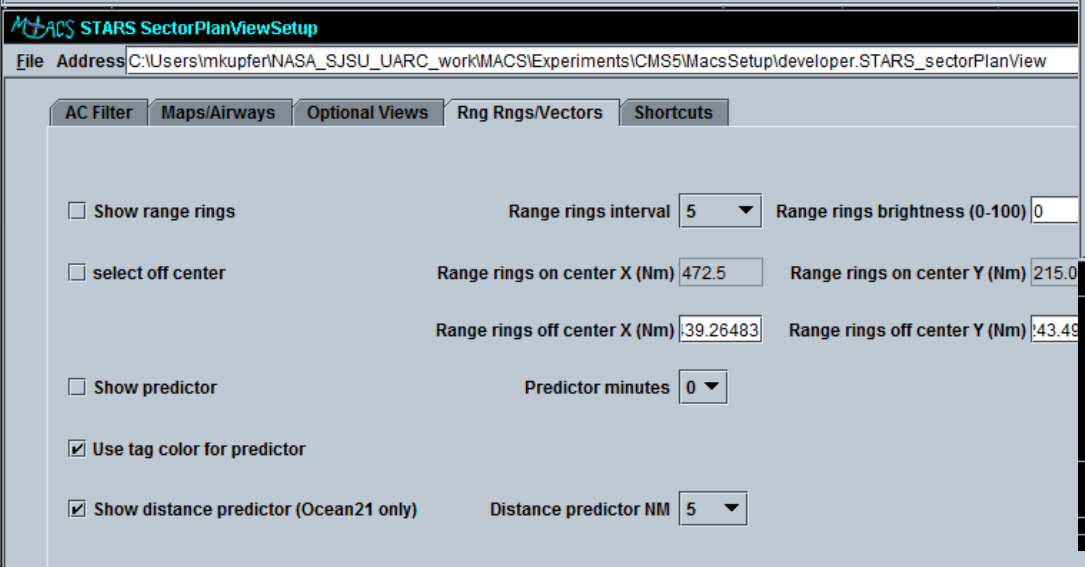
Data Link

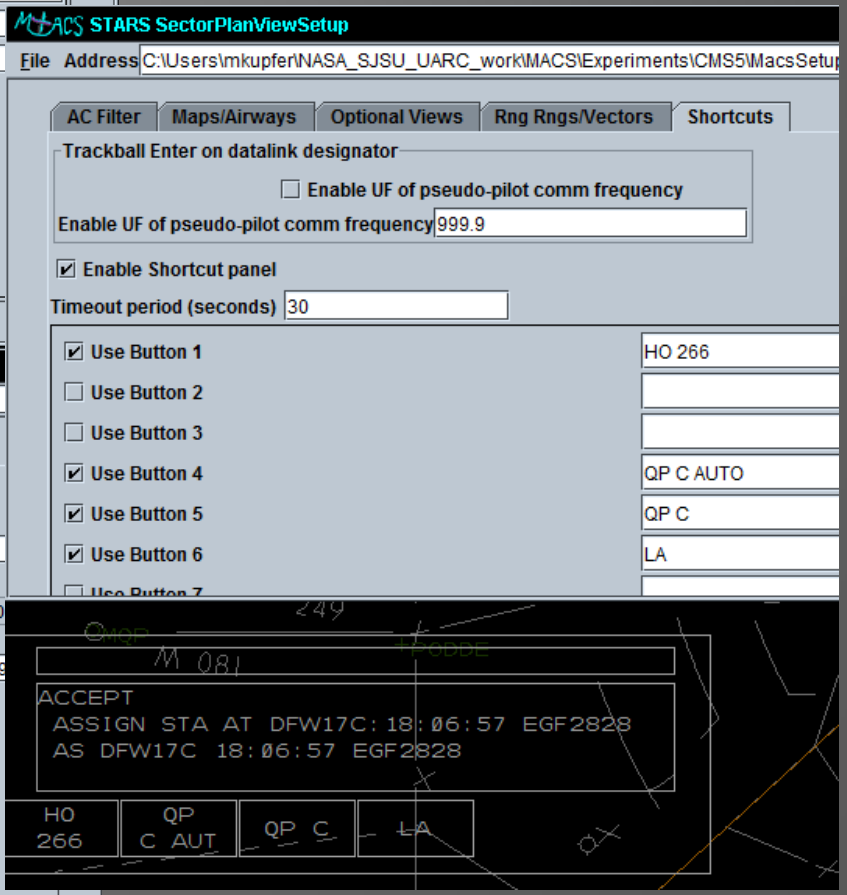
- Enable/disable DL
- Define requirements and parameters
- Transfer of Communication (TOC)

STARS / DSR SectorPlanView Setup

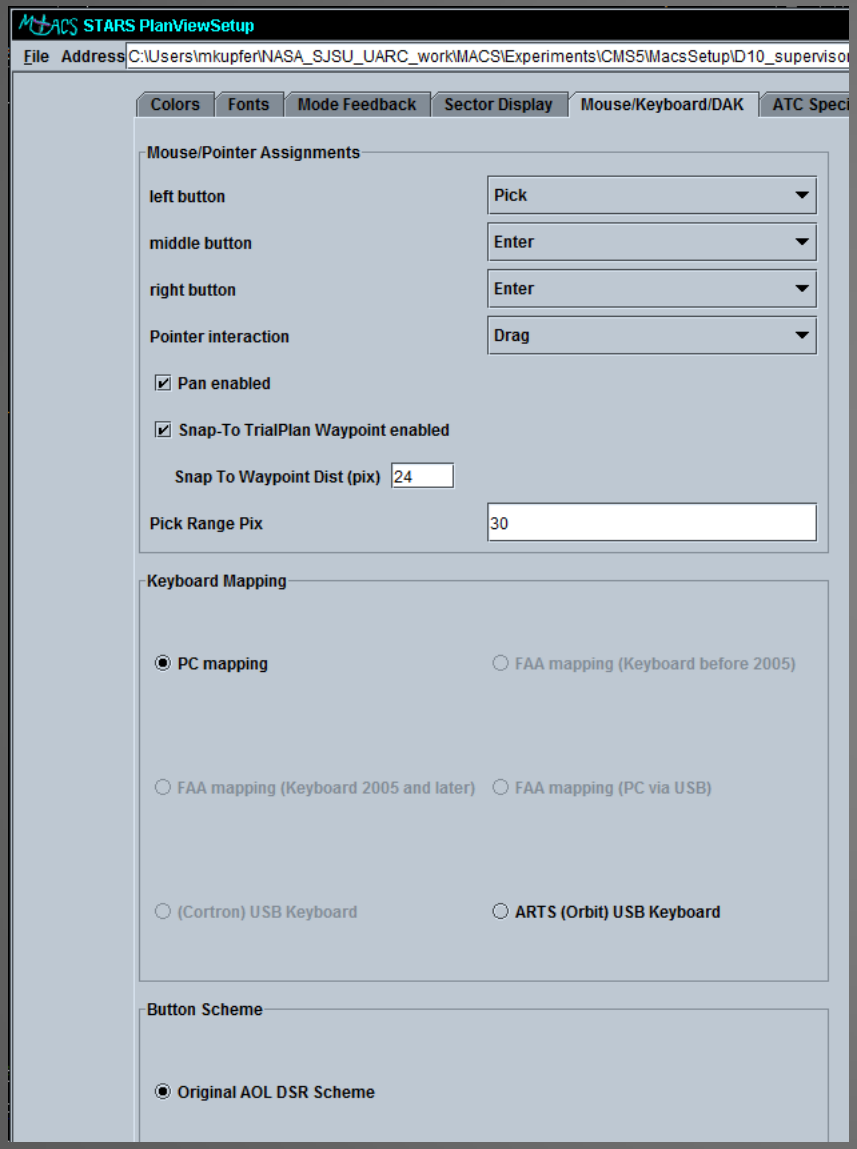
- Modify appearance of scope

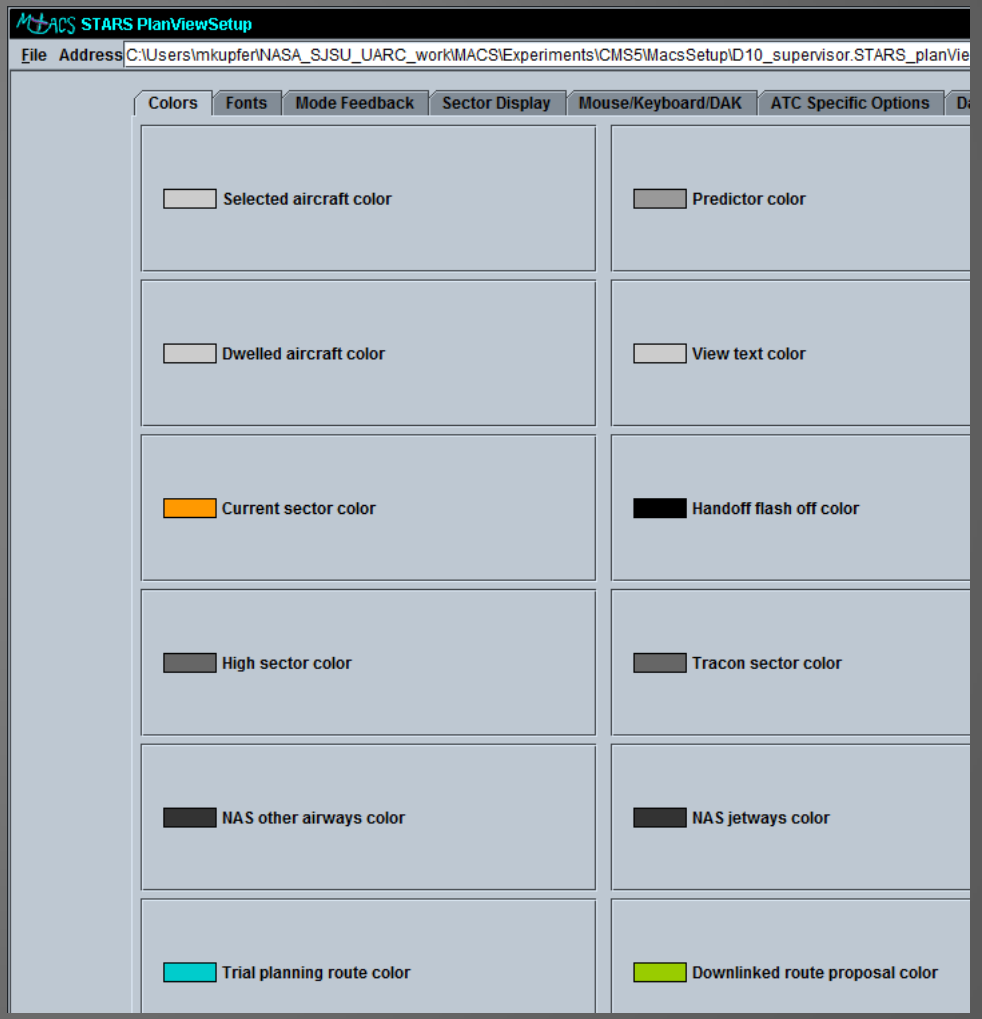




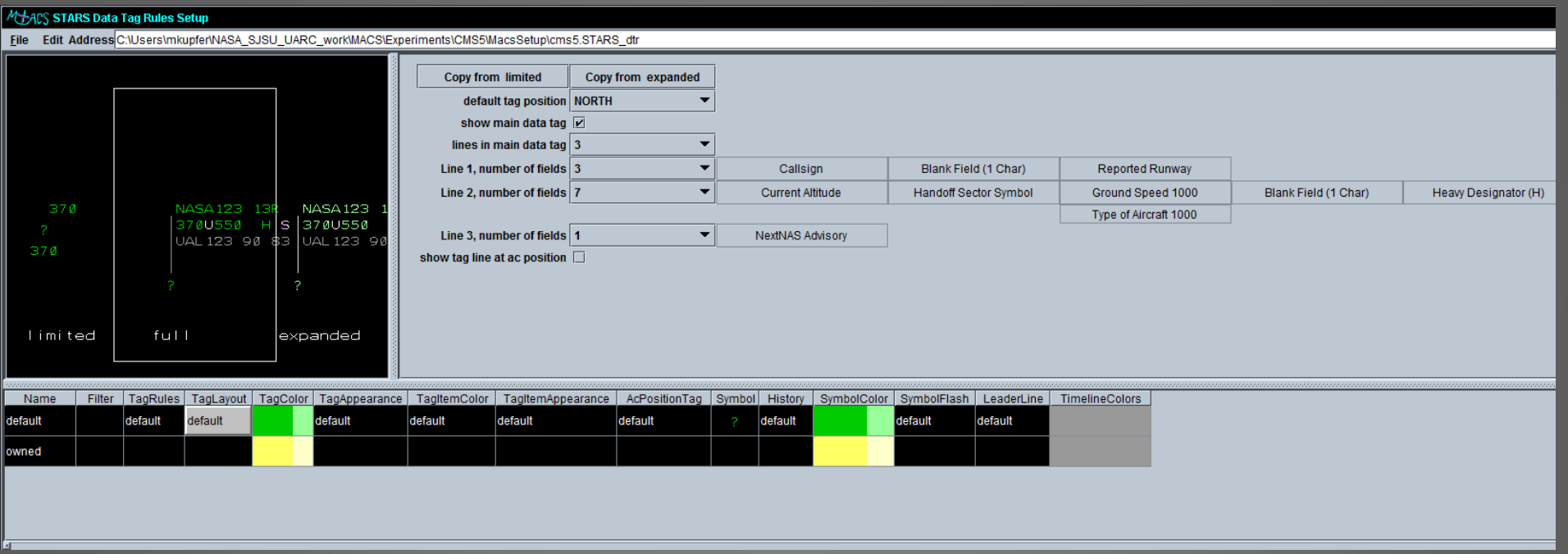


Some other STARS / DSR PlanView Setup taps





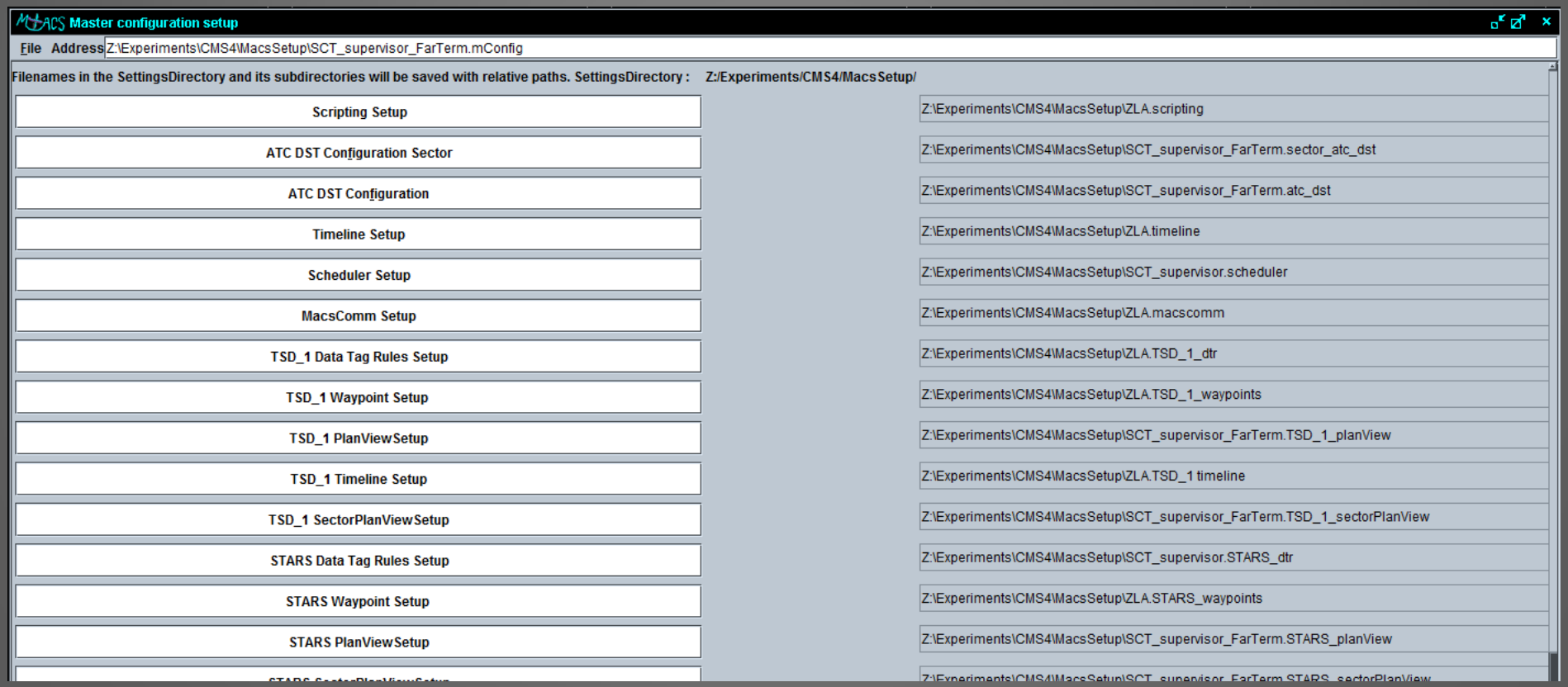
STARS Data Tag Rules Setup



- Design the appearance of the data tags in the STARS display
- Use filters to create rules for different sub-groups of aircraft
- Set the correct priority of rules in the list
- More information: https://aol1.arc.nasa.gov:8443/display/macs/MACS+Questions+and+Answers

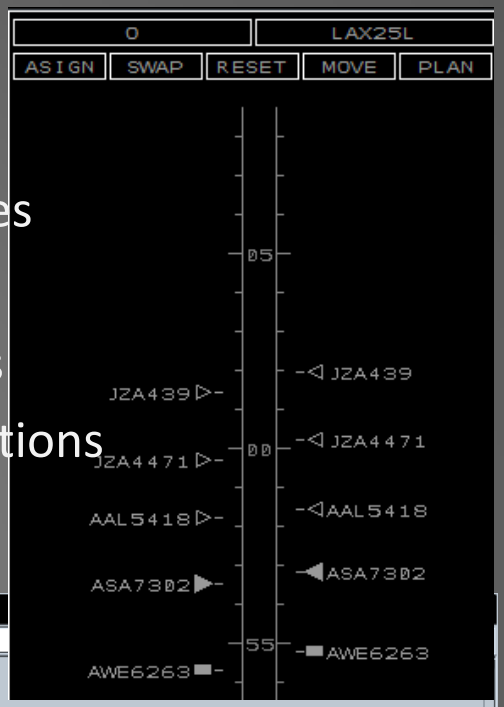
CMS tools → review Master configuration setup

- Settings are specified in various setup files
- Master configuration file holds the references to all available setup files
- Individual vs. common setup file (Attention! Setup file edits)



CMS tools: Timelines

- **STARS / DSR timeline setup** →setup and configure timelines
- **Scheduler setup** →define schedulers used by timelines
- **ATC DST Cofiguration** → ETA/STA tab → STA freeze settings
- **STARS / DSR_1 SectorPlanView Setup** → Define display options



MACS STARS Timeline Setup

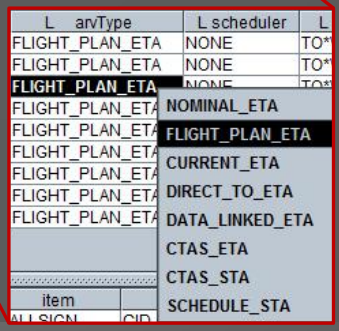
File Edit Address Z:\Experiments\CMS4\MacsSetup\ZLA.STARS_timeline

Slack slop (sec) 4

Overlap slop (sec) 4

timeline	length (min)	gap (min)	ownedOnly	pixPerMin	crossOver	showSlack	showOverlap	assign	swap	reset	move	plan	L arvType	L scheduler	L acFilter	R arvType	R scheduler	R acFilter
LAX24R	25	0	false	35	LAX24R	true	true	false	false	false	false	false	FLIGHT_PLAN_ETA	NONE	FROM	SCHEDULE_STA	LAX24R	FROM
LAX25L	25	0	false	35	LAX25L	true	true	false	false	false	false	false	FLIGHT_PLAN_ETA	NONE	FROM	SCHEDULE_STA	LAX25L	FROM
CULVE	20	0	false	35	CULVE	false	true	false	false	false	false	false	FLIGHT_PLAN_ETA	NONE	FROM	SCHEDULE_STA	CULVE	FROM
SLI	20	0	false	35	SLI	false	true	false	false	false	false	false	FLIGHT_PLAN_ETA	NONE	FROM	SCHEDULE_STA	SLI	FROM
FUELR	20	0	false	35	FUELR	false	true	false	false	false	false	false	FLIGHT_PLAN_ETA	NONE	FROM	SCHEDULE_STA	FUELR	FROM
PALAC	20	0	false	35	PALAC	false	true	false	false	false	false	false	FLIGHT_PLAN_ETA	NONE	FROM	SCHEDULE_STA	PALAC	FROM
SAN27	60	0	false	10	SAN27	true	true	false	false	false	false	false	FLIGHT_PLAN_ETA	NONE	FROM	SCHEDULE_STA	SAN27	FROM

meter list	maxLines	ownedOnly	crossOver	etaType	staType	scheduler	delayDisplayOptions	acFilter	item	item	item	item	item	item	item

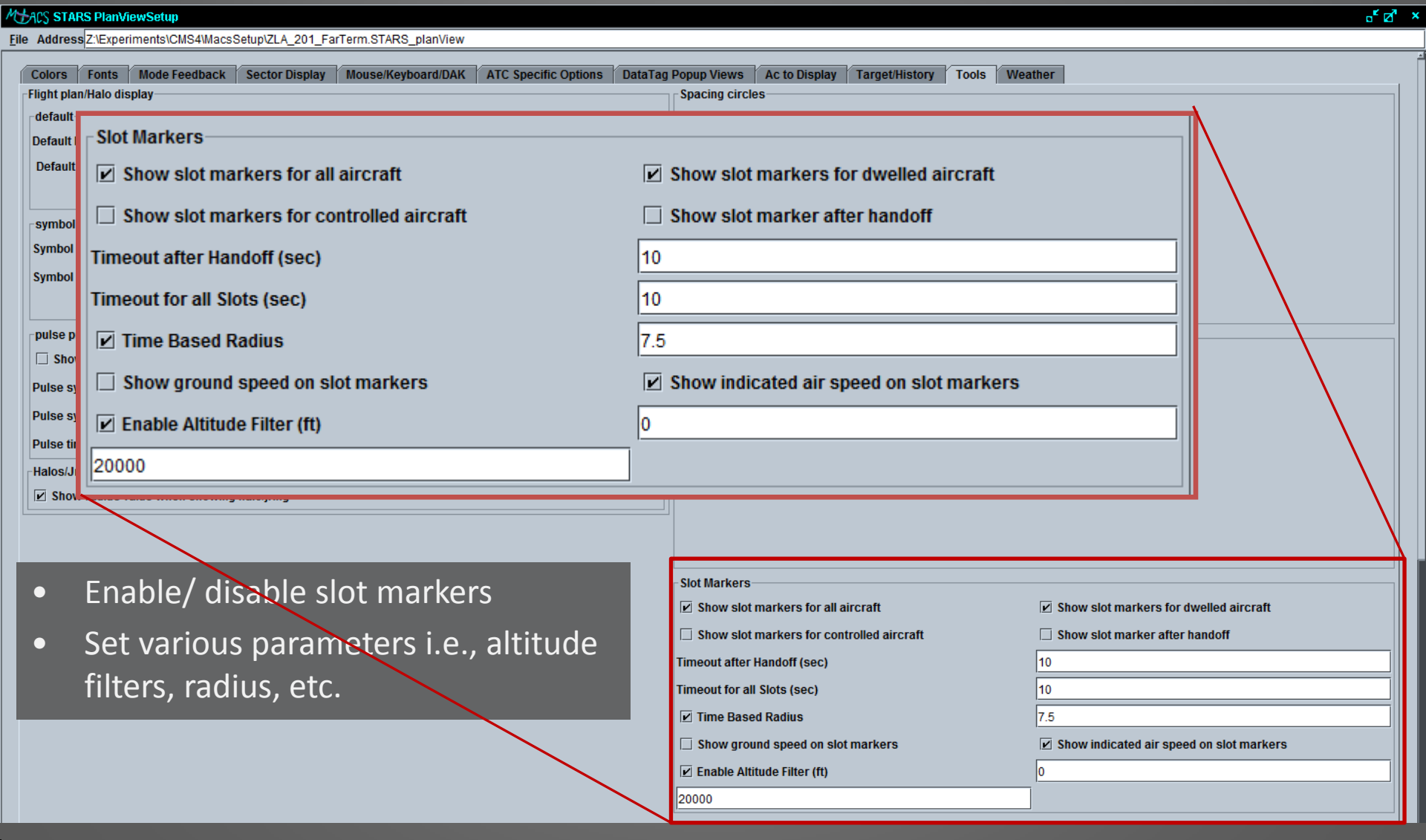


Timeline Setup:

- Define timelines and meter lists
  - ETA/STA types
  - Appearance
  - Filters

CMS tools: Slot markers

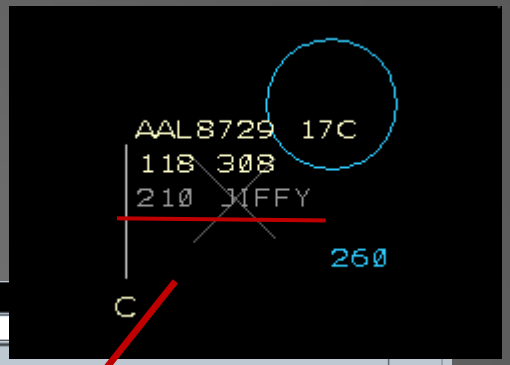
STARS / DSR Plan View Setup → Tools tab



- Enable/ disable slot markers
- Set various parameters i.e., altitude filters, radius, etc.

CMS tools: Speed Advisories

ATC DST Configuration → Advisories tab



MACS ATC DST Configuration

File Address Z:\Experiments\CMS4\MacsSetup\ZLA_201_FarTerm.atc_dst

Conflict Alert | Airline Filter | Traffic Load | Conflict Probe | Data Link | Sta Freeze | Advisories | Weather Probe | Dynamic Sector

General Settings | InActive Ac Participtation | Combined sectors | State Source | Traj Filters | Handoff | H/O Autonomous

4D Trajectory Logic

LOGIC TYPE: SPEEDS_FOR_NOMINAL_OPD — Tactical Speeds to join Nominal Optimal Profile Descents

Enabled ☑

STA assignment required ☑

speed advisories enabled ☑ Early/Late indication enabled ☑

Min secs ac must be late to show advisory or late time: 1

Min secs ac must be early to show advisory or early time: 1

Min secs ac must be late to compute advisory: 5

Min secs ac must be early to compute advisory: 5

Minimum Altitude to be included: 2200.0

Maximum Altitude to be included: 25000.0

ASTAR use dynamic (FMS active) trajectory ☐

ASTAR use ATC procedures ☐

Use Next Schedule Point only for Speed Advisory ☑

MACS Mode Control Panel AAL8729

SPEED | MACH | 234 | HEADING

SPD SEL | VNAV | SPACING | HDG SEL | LNAV

UNTIL >> | JIFFY | SET >> | 210 | <LEFT

Minimum Altitude to be included: 1000.0

ASTAR use dynamic (FMS active) trajectory ☐

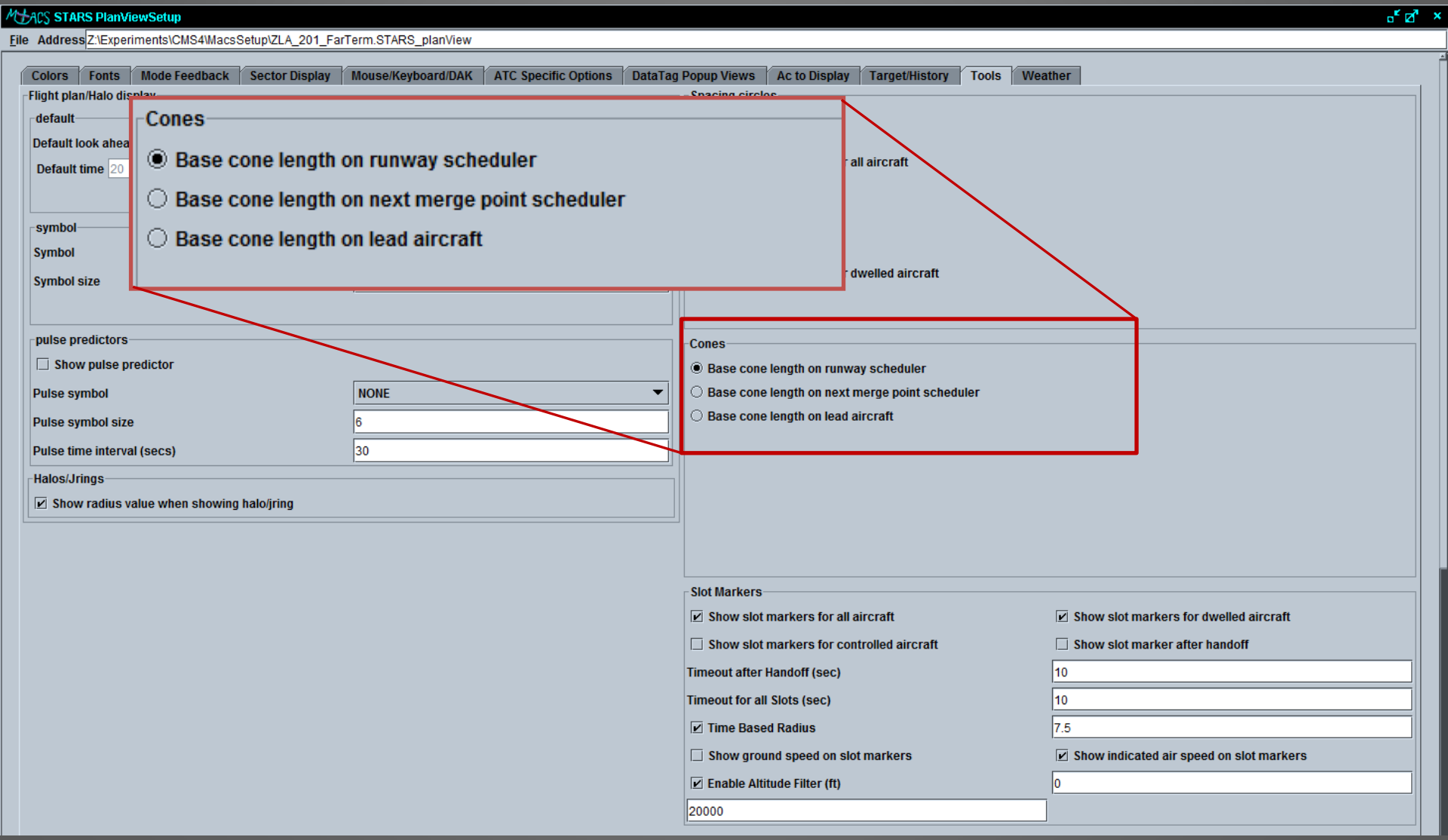
Use Next Schedule Point only for Speed Advisory ☑

Advisories

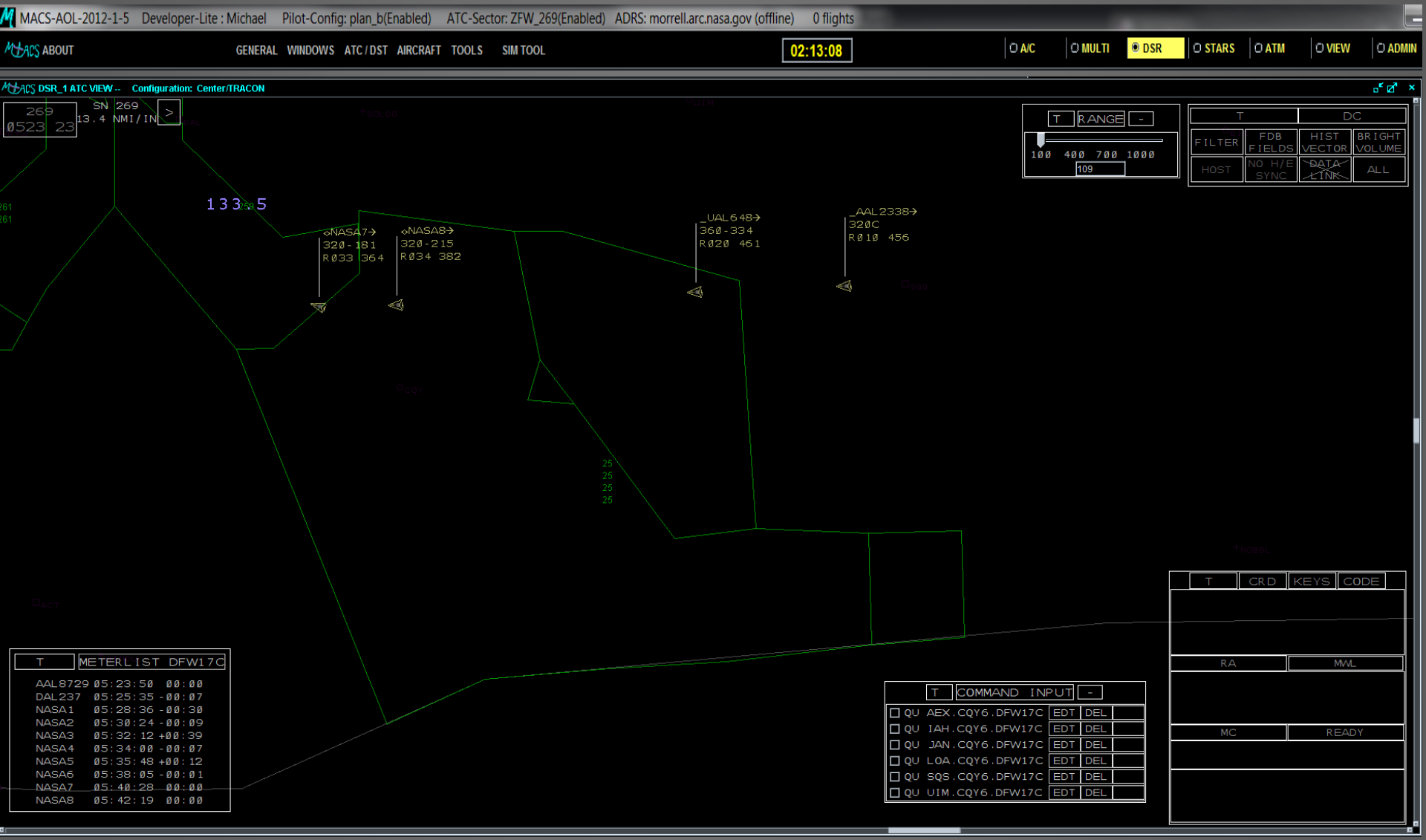
- Enable/disable Speed Advisories, Early/Late indicators
- Set parameters for when advisories are displayed
  - STA required
  - Bounds for ETA-STA error
  - Altitude bounds
  - Schedule point

Spacing cones

STARS / DSR Plan View Setup → Tools tab



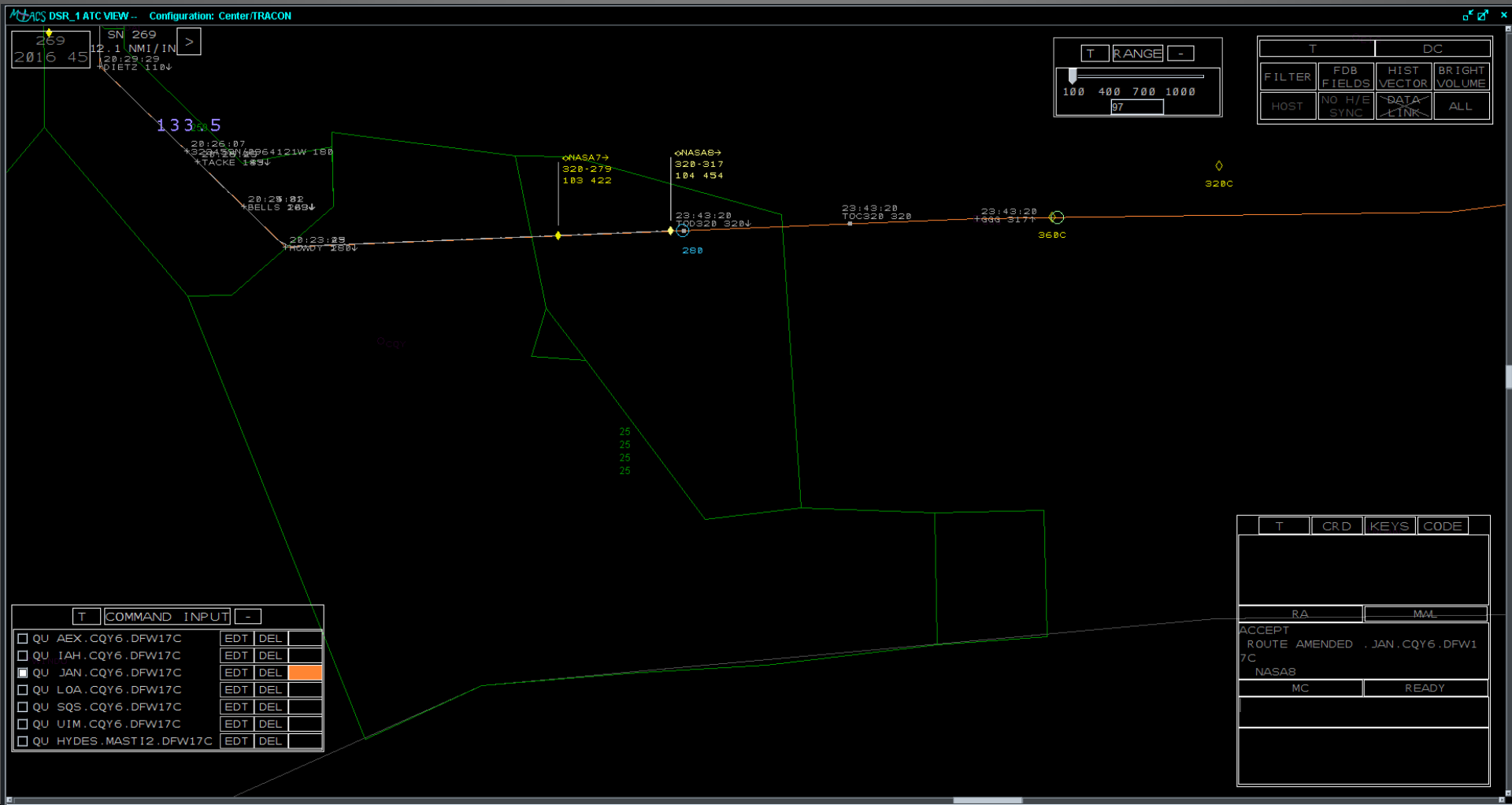
Examples Controller Stations: Center controller (DSR)



Assign atc_procedures to ASTOR aircraft

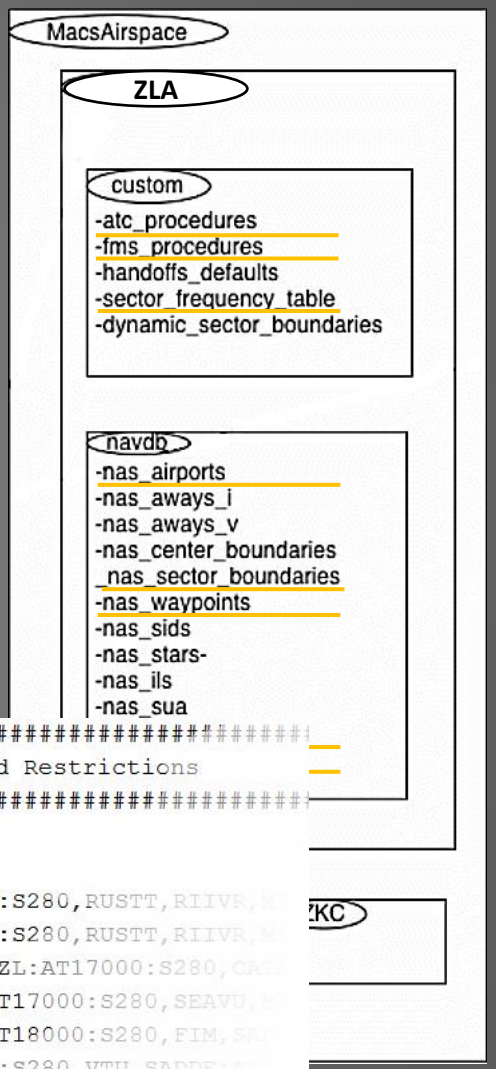
- QU <name of atc_procedure> <callsign>
- Command input panel provides shortcuts
- Preview and color coding function

DSR display (possible in STARS, too)



Adjusting the Airspace Adaptation

- atc_procedures: defining atc routes




```
#########################################################################################################################
#TYPE       AIRPORT RWY ENTRYFIX    TYPE    Name            DescentCas  Range   Waypoints and Restrictions
#########################################################################################################################
#
#LAX24R
ARRIVAL     LAX     LAX24R  HEC     JET     HEC.RIIVR2.LAX24R   300    200  HEC,GRAMM:AT17000:S280,RUSTT,RIIVR,
ARRIVAL     LAX     LAX24R  PGS     JET     PGS.RIIVR2.LAX24R   300    200  PGS,GRAMM:AT17000:S280,RUSTT,RIIVR,
ARRIVAL     LAX     LAX24R  TNP     JET     TNP.SEAVU2.LAX24R   300    200  PKE,TNP,IPHIW,KONZL:AT17000:S280,
ARRIVAL     LAX     LAX24R  JLI     JET     JLI.OLDEE1.LAX24R   300    200  HIIHO,JLI,LAADY:AT17000:S280,SEAVU,
ARRIVAL     LAX     LAX24R  AVE     JET     AVE.SADDE7.LAX24R   300    200  AVE,REYES,PIRUE:AT18000:S280,FIM,
ARRIVAL     LAX     LAX24R  RZS     JET     RZS.SADDE7.LAX24R   300    200  RZS,DEANO:AT20000:S280,VTU,SADDE:
```

atc_procedures file

..\MacsAirspace\ZFW_DFW\custom\

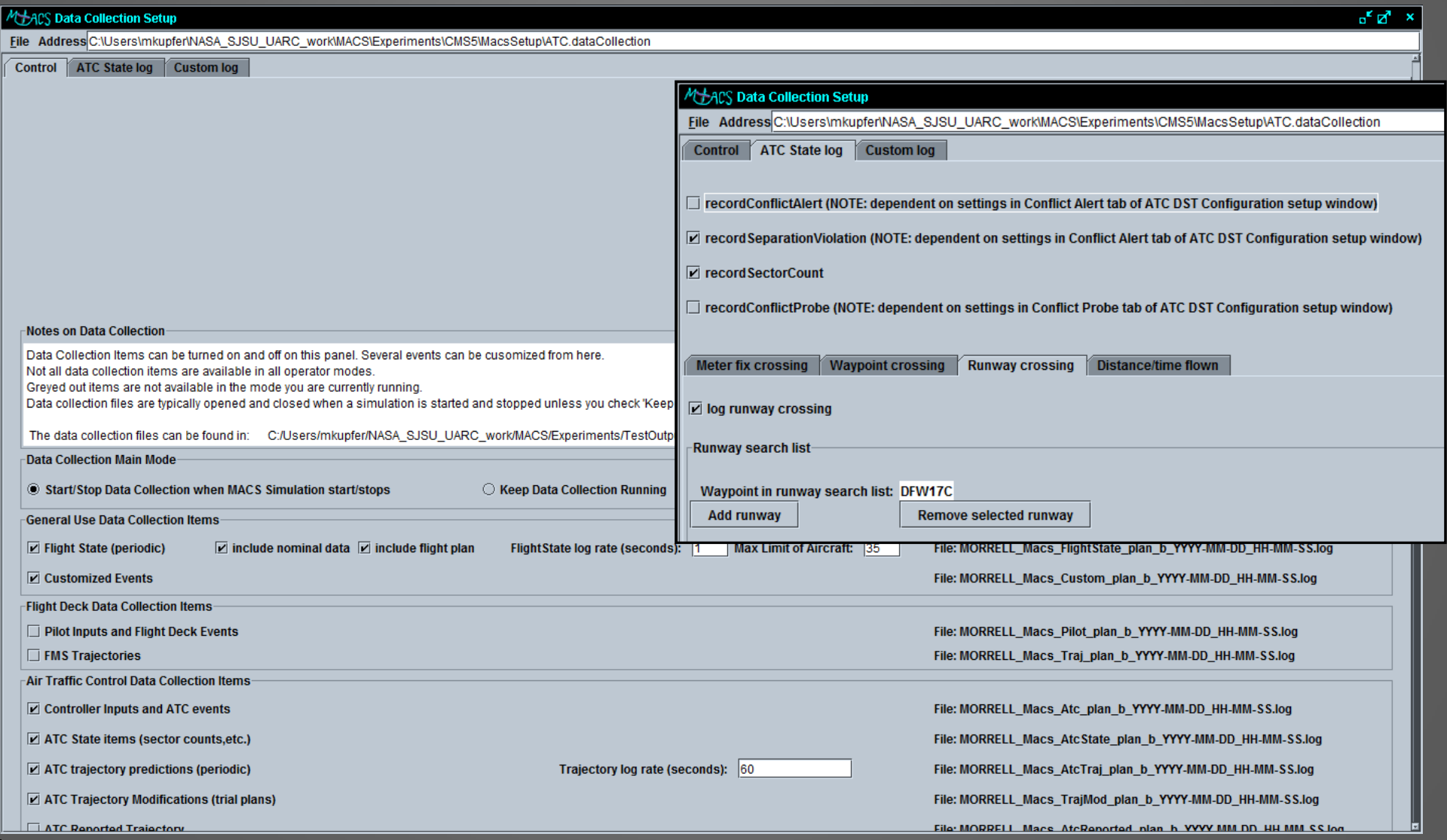
TUL,LOSZY,MAMEE,BIRLE,GAATZ,BYP,KARLA:AT13000:S260,COVIE:AT11000:S240,
LEMYN,CARBN:AT6000:S210,PENNY:AT5000:S190,ZINGG,JIFFY:AT2300:S170,
DFW17C:AT562

```
ARRIVAL        DFW DFW17C  MLC         JET     MLC.BYP5.DFW17C          280          200     MLC,KARLA:AT13000:S260,COVIE:
ARRIVAL        DFW DFW17C  PRX         JET     PRX.BYP5.DFW17C          280          200     PRX,KARLA:AT13000:S260,COVIE:
ARRIVAL        DFW DFW17C  TUL         JET     TUL.BYP5.DFW17C          280          200     TUL,LOSZY,MAMEE,BIRLE,GAATZ,B
#
ARRIVAL        DFW DFW17C  HYDES           JET     HYDES.MASTY2.DFW17C     280          200     HYDES,CHARE,SEANN,MARDY,M
ARRIVAL        DFW DFW17C  IRW         JET     IRW.MASTY2.DFW17C        280          200     IRW,MOOSE,GREGS:AT10000:S240,
```

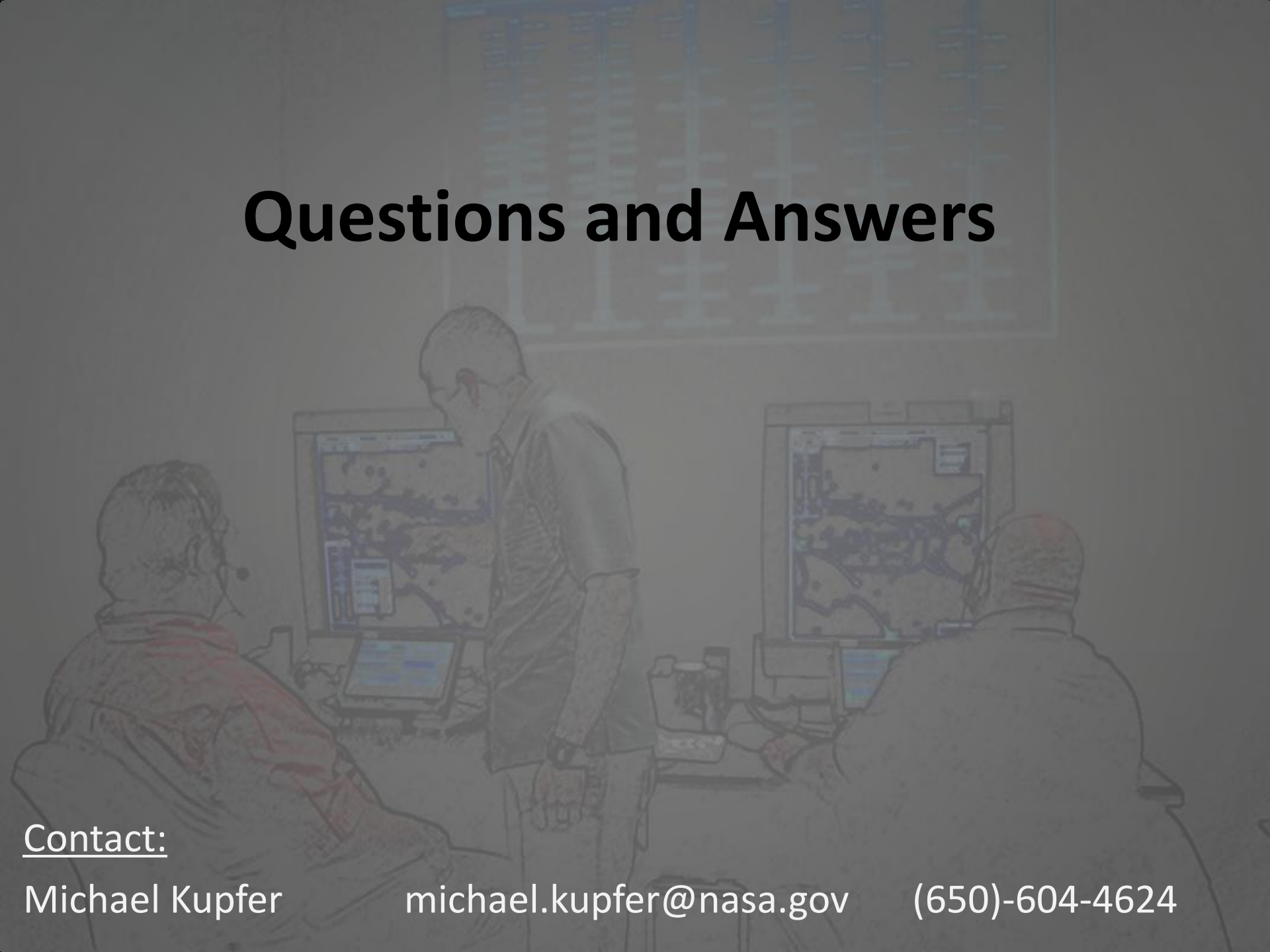
- Used by cms tools
- Assign atc_procedure to ASTOR aircraft to get slot marker (QU command)

Data Collection Setup

- Define which data collection items will be logged and in which frequency
- Data output directory is defined in Scenario Control



Questions and Answers



Contact:

Michael Kupfer michael.kupfer@nasa.gov (650)-604-4624

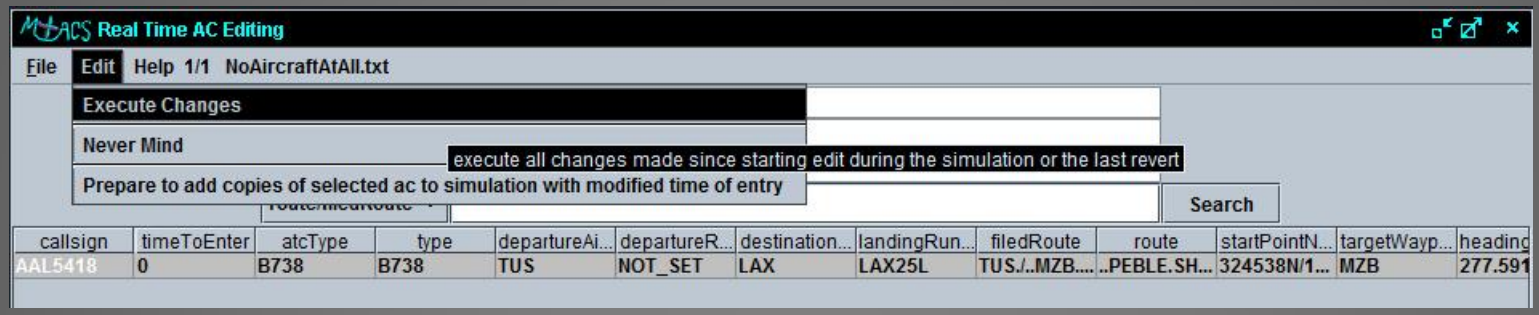
Simulation Supervision

During simulation possible tasks may be:

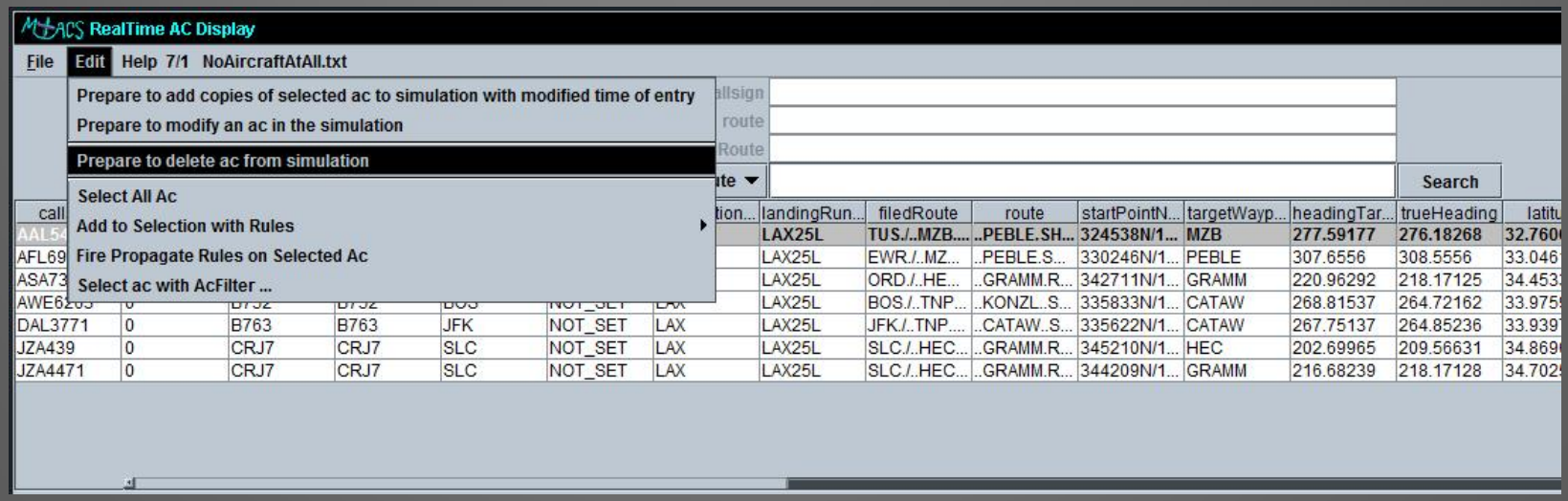
- Modify controller displays (colors of tools, datablock layout, etc., bring up timelines)
- Restart station
  - Wrong shortcut loaded initially
  - Problems with displays
- Real time flight monitoring (XY Trajectory Panel)
- Assist pseudo pilots
- Delete aircraft

Real Time Control Panels

- Real Time AC Editing (duplicate, modify non-initialized, or delete aircraft)



- Real Time AC Display: prepare to delete aircraft)



- From flight deck view …
- Switch to STARS display and let them click a bit (dwelling over a/c, bring up route, move datablock, …)
- Go over CMS tools
  - Point out Master config file and that besides other functions and features, CMS tools can be turned on/off + parameters from various setup files within MACS
  - Timeline
    - Go through functions in GUI, meterlist
    - Walk through timeline setup (maybe modify/add a timeline), how to bring up a TL, sector specific setup
    - Scheduler setup, atc dst setup: sta freeze
  - Slot markers
    - Stars plan view setup (see how settings change what happens on the cope)
  - Speed advisories and E/L indicators
    - Atc DST Config
    - Show how pilots would enter such a clearance in MACS
  - Cones
- Talk about fms- and atc procedures (bring up respective files)
- Talk about other atc/dst configuration tabs: state source, data link, conflict probe, handoff (go back to STARS/flight deck and show HO)
- Show how to change Datablock, waypoints, scope appearance
- Talk about other functions in STARS planview setup (colors, mouse/keyboard, …)
- Data collection setup
- Scenario Control (bundles, traffic file, winds, data directory, …)
- Switch to DSR
- Go over how to assign ATC route to an (ASTOR) aircraft
- Point out DSR/STARS similarities (data tag rules display, waypoints, etc)
- Point out sectors file (sectors file: set sector name, position symbol, etc.)